DOCUMENT RESUME

ED 115 482 SE 019 747

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TITLE Metric Measurement.
INSTITUTION North Dakota Univ., Grand Forks. Dept. of Mathematics.
PUB DATE 75
NOTE 101p.

EDRS PRICE MF-$0.76 HC-$5.70 Plus Postage
DESCRIPTORS *Elementary School Mathematics; Instruction; Mathematics Materials; *Measurement; *Metric System; *Resource Materials; *Secondary School Mathematics; Teacher Developed Materials

ABSTRACT

This resource book of metric lessons was prepared by the Metric Systems Class at the University of North Dakota. Length, area, volume and capacity, mass and weight and temperature are developed through techniques such as puzzles, manipulative devices, and experiments. Activities are described in terms of materials needed, directions, and follow-up questions and/or activities. There is a wide variety of useful metric activities for each measurement concept. (JBW)

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METRIC MEASUREMENT

by

UND MATHEMATICS DEPARTMENT

1975

EDITOR DR. GLENN PRIGGE

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Introduction

The following lessons were written by the Metric System class taught by the Mathematics Department at the University of North Dakota during the summer of 1975. The class was composed of the following elementary school personnel:

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The manuscript was typed by the Mathematics Department work study student Wendy Bush.

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LENGTH

AND

AREA

SEEING THE NEED FOR A STANDARD MEASURE

Materials: Ball of string, dry beans approximately one centimeter in size, and unmarked sticks of varying lengths up to one meter; paper for students' recordings.

Have the children cut a string, any length.

In the classroom have them find:

ORAL:

two things longer than your string
two things shorter than your string
two things the same length as your string

Using the same string, first guess how many times your string will be needed to measure the following things.
Record your guesses on your paper.

how long your pencil is
how wide your desk is
how high the blackboard is

Now measure them to see how close your guess was and record it.

Using the beans estimate and measure the following: record.

the width of an eraser
the length of your foot
the width of the doorway

Take one of the colored sticks from the box. Estimate and measure as you have been doing. Remember to record.

how long your reading book is
how wide the room is
how long the room is

Questions for discussion:

1. Which unit was the easiest with which to measure, the string, bean, or stick? Why? Did it depend upon what you were measuring?

2. What happened when you compared your measurement findings with your neighbor's findings? What could you do to change this difference?

3. How could you tell someone outside of this classroom how wide your desk is?

4. Can you think of a better way we could measure?

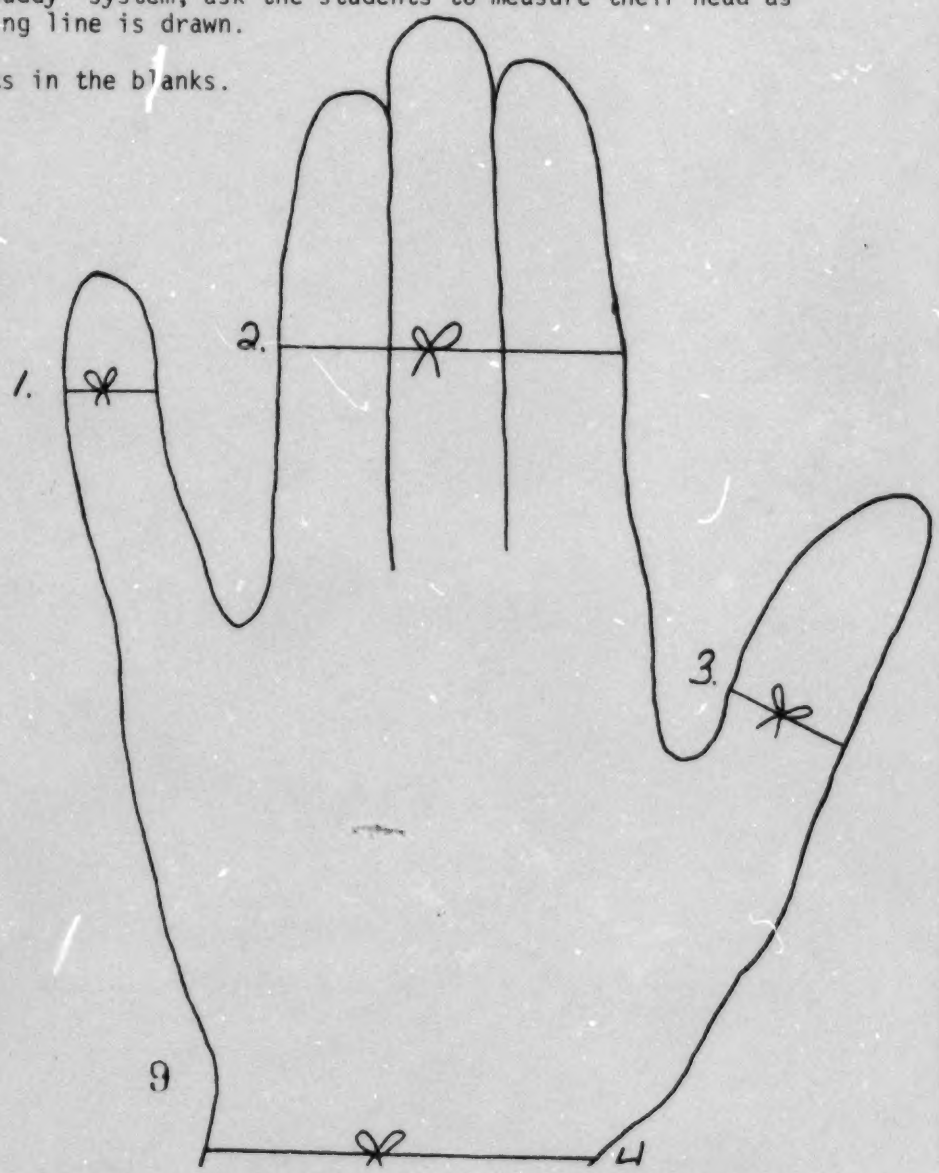
HEAD AND HAND MEASUREMENT

Materials: Pencils, paper, string, scissors, metric rule.

Instructions to the teacher:

1. Ask each student to draw his left hand, as the example has been drawn, omitting the numbered string lines.
2. Ask each student to draw a profile of his partner's head, as the example has been drawn, omitting the string lines.
3. Show the students the appropriate metric measure and ask them to "guess" the length of the strings in each example.
4. Working in teams of two or three have the students measure their hand as the numbered string line is drawn.
5. Using the same "buddy" system, ask the students to measure their head as the numbered string line is drawn.
6. Record the results in the blanks.

1. _____ cm
2. _____ cm
3. _____ cm
4. _____ cm

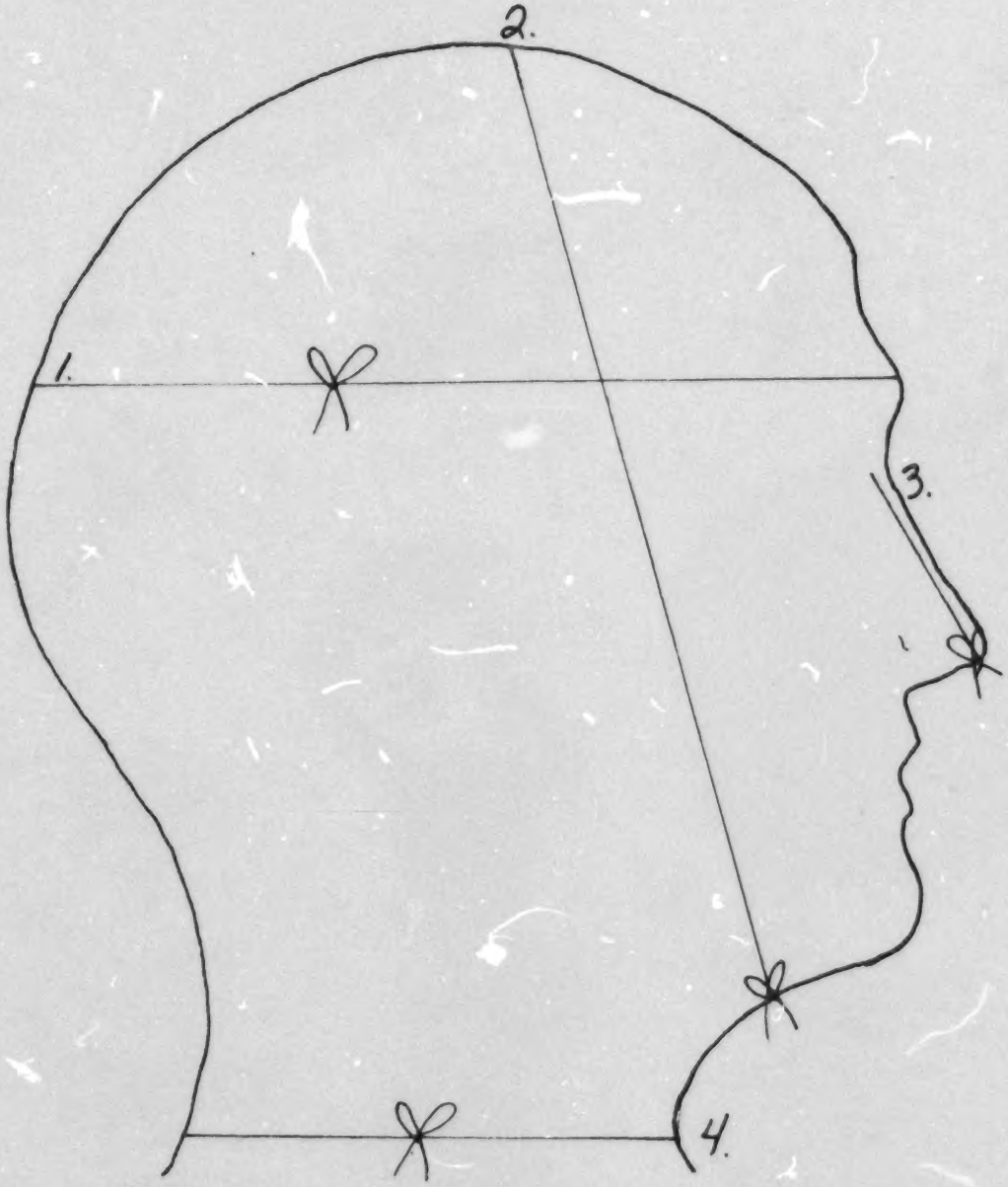


1. _____ cm

2. _____ cm

3. _____ cm

4. _____ cm

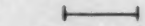


STANDARD MEASUREMENT - MAKING A METRIC RULER

Materials: Tagboard or poster paper 20cm x 3cm to back rulers

A centimeter is a standard unit of measure

This is a centimeter



1 Centimeter

_____

Find something that measures 1 centimeter.

How wide is the tip of your little finger?

Find something that measures less than 1 centimeter.

How wide is your pencil?

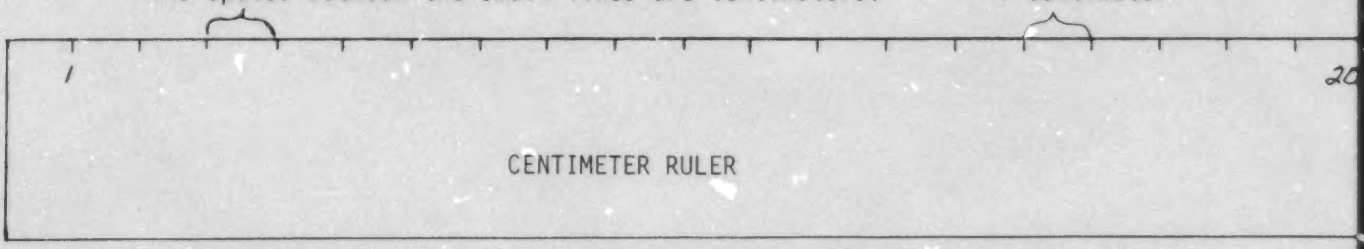
Find something that measures more than 1 centimeter.

_____

Let's make a device that we can use to measure things that are more than 1 centimeter.

This is a ruler.

The spaces between the small lines are centimeters. 1 centimeter



CENTIMETER RULER

How many spaces are there? _____ How many centimeters are there? _____

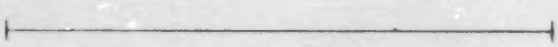
There are 20 spaces or centimeters on this ruler.
Number the centimeters by writing the numbers from 1 to 20 under the small lines on the ruler. The numbers 1 and 20 are already there.

Cut out your centimeter ruler.

Paste your centimeter ruler to the paper strip that your teacher has given you. This will make it stronger.

Use your centimeter ruler to make the measurements on the following page.

Guess how long the lines are. Then measure them to see how close your guess was.

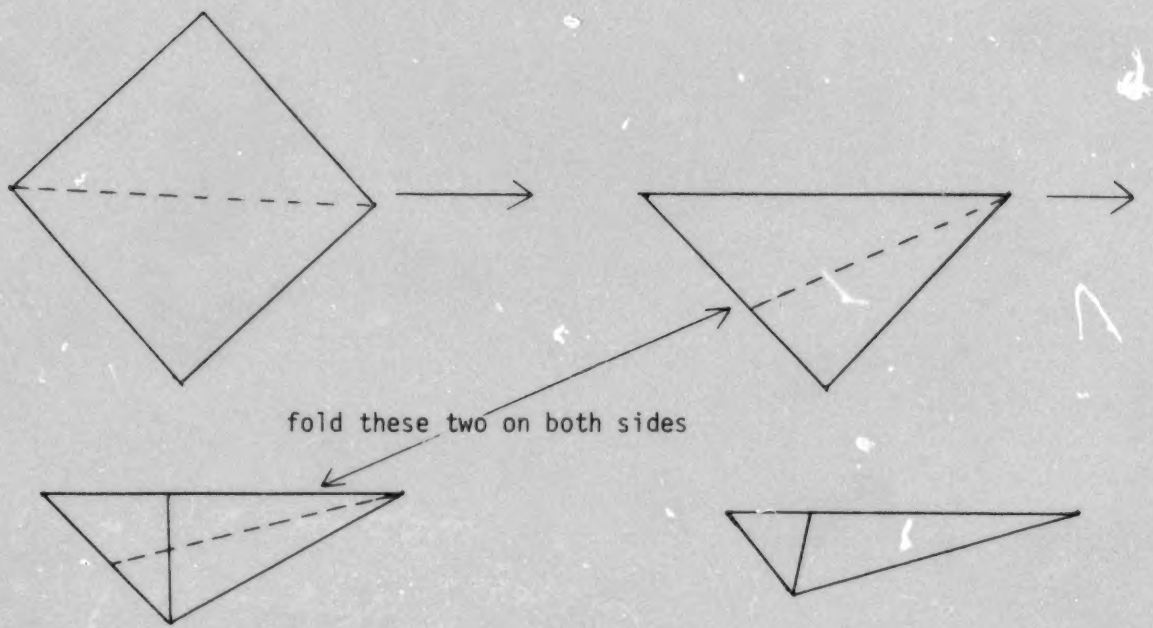
Record your Guess		Record your Measure
_____ cm		_____ cm
_____ cm		_____ cm
_____ cm		_____ cm
_____ cm		_____ cm
_____ cm		_____ cm
_____ cm	How long is your pencil?	_____ cm
_____ cm	How long is your foot?	_____ cm
_____ cm	Measure a book.	_____ cm
_____ cm	Measure your desk top.	_____ cm

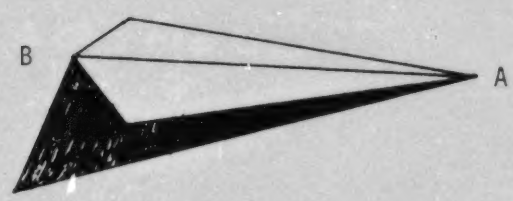
METRIC AIRPLANE

1. Make a paper airplane any size from a square piece of paper.

Folding directions:

Fold along dotted lines





2. Measure your airplane from the tip (point A) to the end (point B). How many centimeters long is it? _____ cm

3. Is it longer or shorter than the person's next to you? _____

4. Throw your airplane three times and record the distance it flies each time in the chart below.

1	2	3
_____cm _____ m	_____cm _____ m	_____cm _____ m

cm - centimeters

m - meters

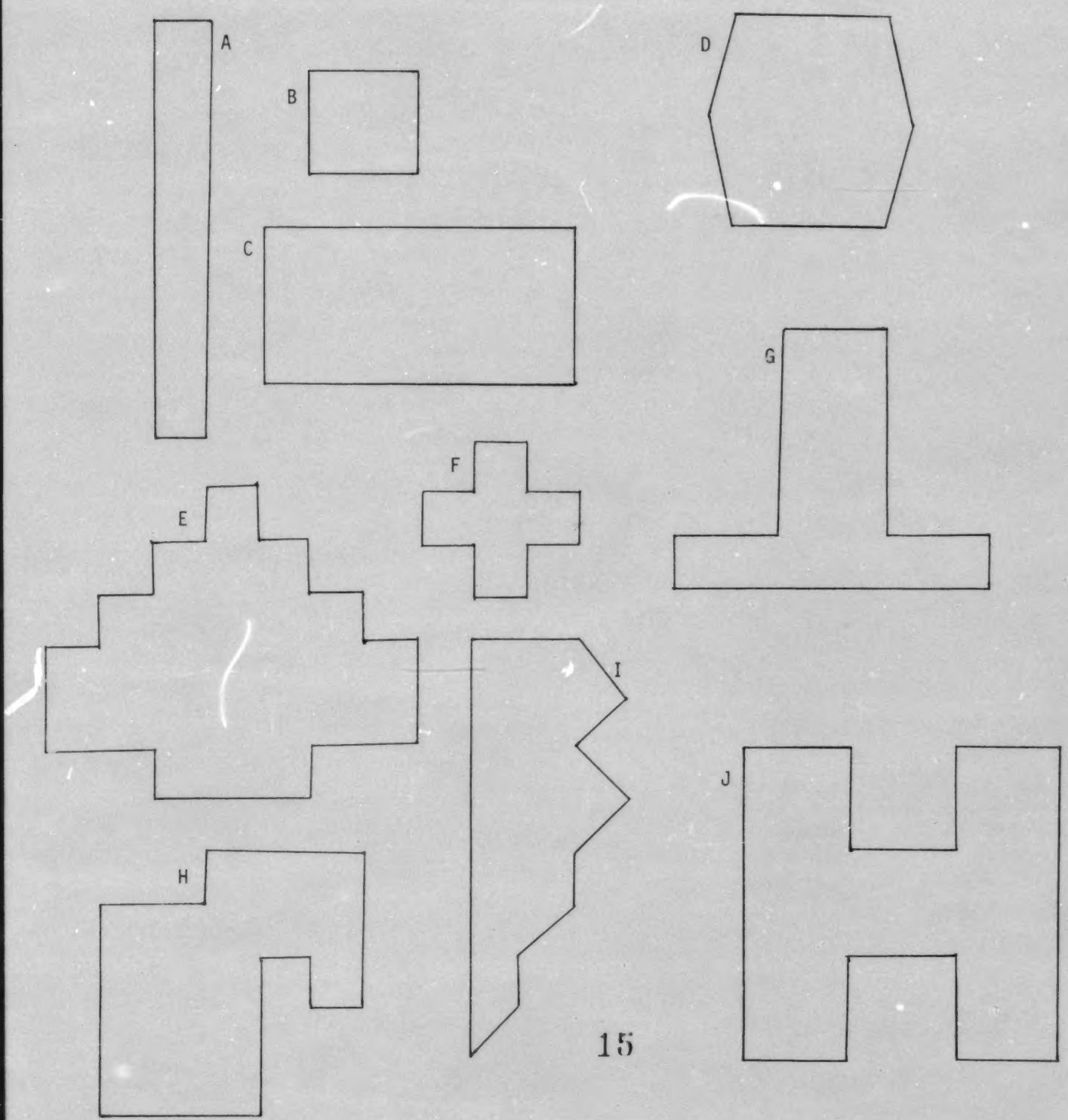
5. Which throw went the longest distance? _____

6. Which throw went the shortest distance? _____

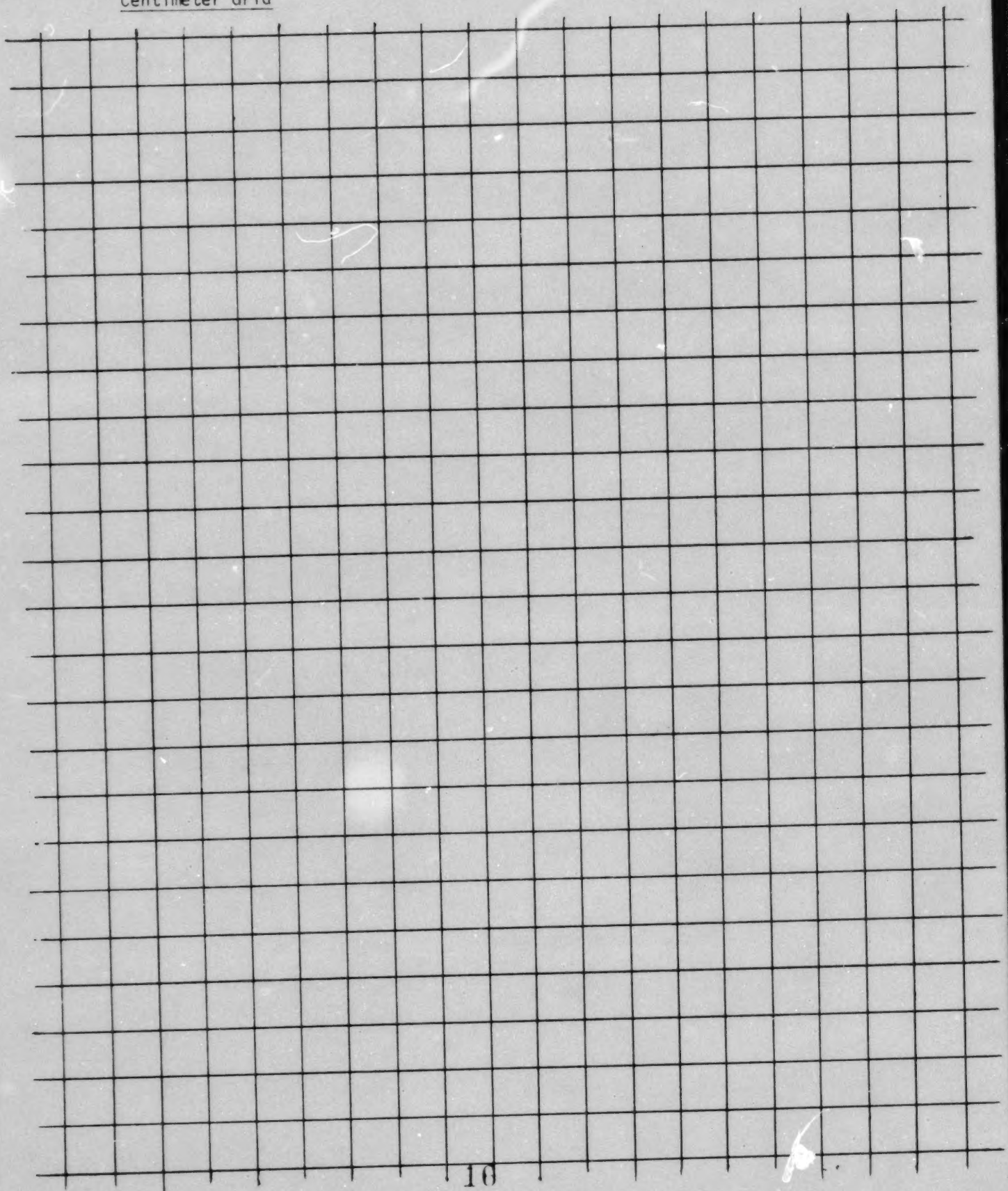
7. Compare with a friend.

AREAS

Cut the centimeter grid (on the following page) into squares along the solid lines. 1 square = 1 sq. cm or 1 cm^2. Glue enough squares on each geometric shape to cover it. Disregard parts of a sq. cm. Determine the area of each shape by counting the number of glued-on squares and record the areas in the chart.



Centimeter Grid



Complete the chart.

SHAPE	AREA (cm^2)
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	

MATCHING LENGTHS

By estimation draw a line to the one with the same length, then check with the use of a centimeter rule.

1.

2.

3.

4.

5.

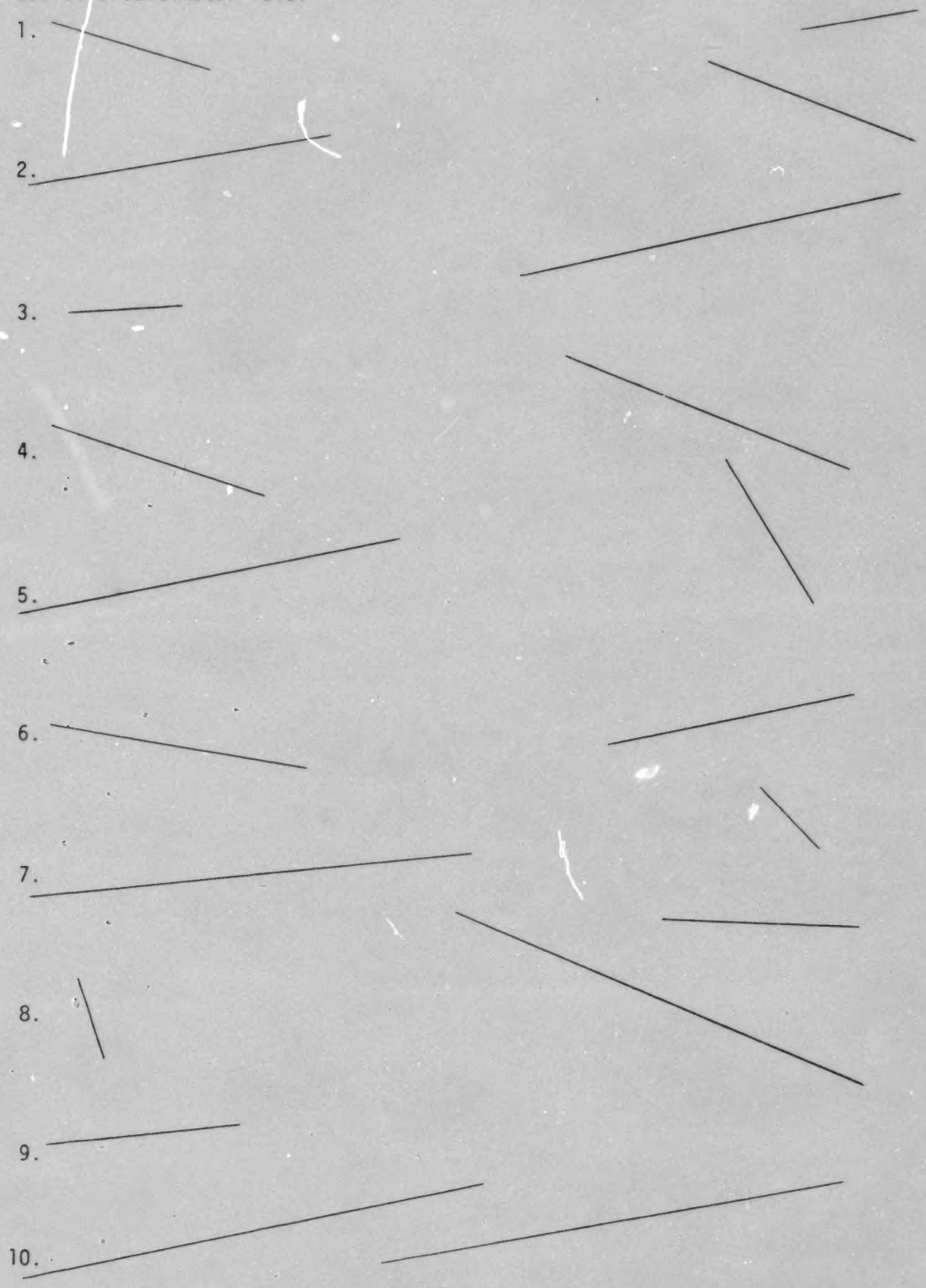
6.

7.

8.

9.

10.



TO BECOME ACQUAINTED WITH THE SQUARE CENTIMETER

Materials: Cuisenaire rods; centimeter squared paper

Metric measurement of areas is done exactly the same way as with the American measurements - you find how many unit areas it takes to cover the area you are measuring. The only difference is that you use different unit areas than with American measurements. One metric unit that is good for measuring fairly small areas is the square centimeter. This is a unit area with each side being one centimeter long. Square centimeters can also be written as sq. cm. to save writing. On a sheet of centimeter squared paper, check to see that the squares are really one centimeter on a side by measuring one of the squares with your ruler. With your pencil, shade in one square centimeter (1 sq. cm.). Try comparing 1 sq. cm. with some things like your fingernails or your pencil eraser. List some things that are about the same area as 1 sq. cm. _____

You need a set of rods if you don't already have some. Compare the rods to the centimeter squared paper. You can see that the rods have metric measurements. Notice that the unit rod (and the square ends of all the other rods) exactly covers 1 sq. cm. Each face of the unit rod has an area of 1 sq. cm. How many sq. cm. can you cover with the other rods? You will find the rods with different colors cover different areas, and that rods with the same color cover the same area. Can you prove that? Explain _____

The things you already know about the rods work for area. For instance, you know that a dark green (D) rod is as long as a train of one purple (P) and one red (R) rod. On the centimeter squared paper trace around a D rod and shade in the area it covered up. Now you can prove a train of one P and one R has the same area as the D rod by exactly covering up the shaded area with the P and R rods. Try this same thing with other color rods, until you are sure the things you already know about the rods work for area.

If you had to find out the area of something, one way you could do it is to cover the outline of the thing with unit rods and then count how many rods it took. Find the area of your pencil, or your eraser, or something fairly small like the lense of your glasses (if you have a pair), by first tracing the outline of the object on a piece of paper and then covering the outline as exactly as you can with unit rods. What did you trace?_____ How many unit rods did it take to cover the outline?_____ What was the area?_____ sq. cm. If you were lucky and the object you picked wasn't too big, you had enough unit rods to cover the outline. But for something bigger like a book, you would run out of rods to cover the outline. Something you might do instead is to trace the outline on centimeter squared paper and then count how many squares are inside the outline. Try it using the outline of your hand on the centimeter squared paper. How many sq. cm. are in the outline of your hand?_____sq. cm. If someone else has finished this, compare the area of your hand with his. Are the areas nearly the same? Why or why not? Try finding the area of something else using the centimeter squared paper. object:_____area:_____sq. cm.

QUESTIONS FOR THINKING AND EXPERIMENTING

Would sq. cm. be a good unit for measuring the area of a postage stamp? _____ Why or why not? _____

Would sq. cm. be a good unit for measuring the area of your footprint? _____ Why or why not? _____

Would sq cm. be a good unit for measuring the area of a tabletop? _____ Why or why not? _____

Would sq. cm. be a good unit for measuring the area of the floor of your room? _____ Why or why not? _____

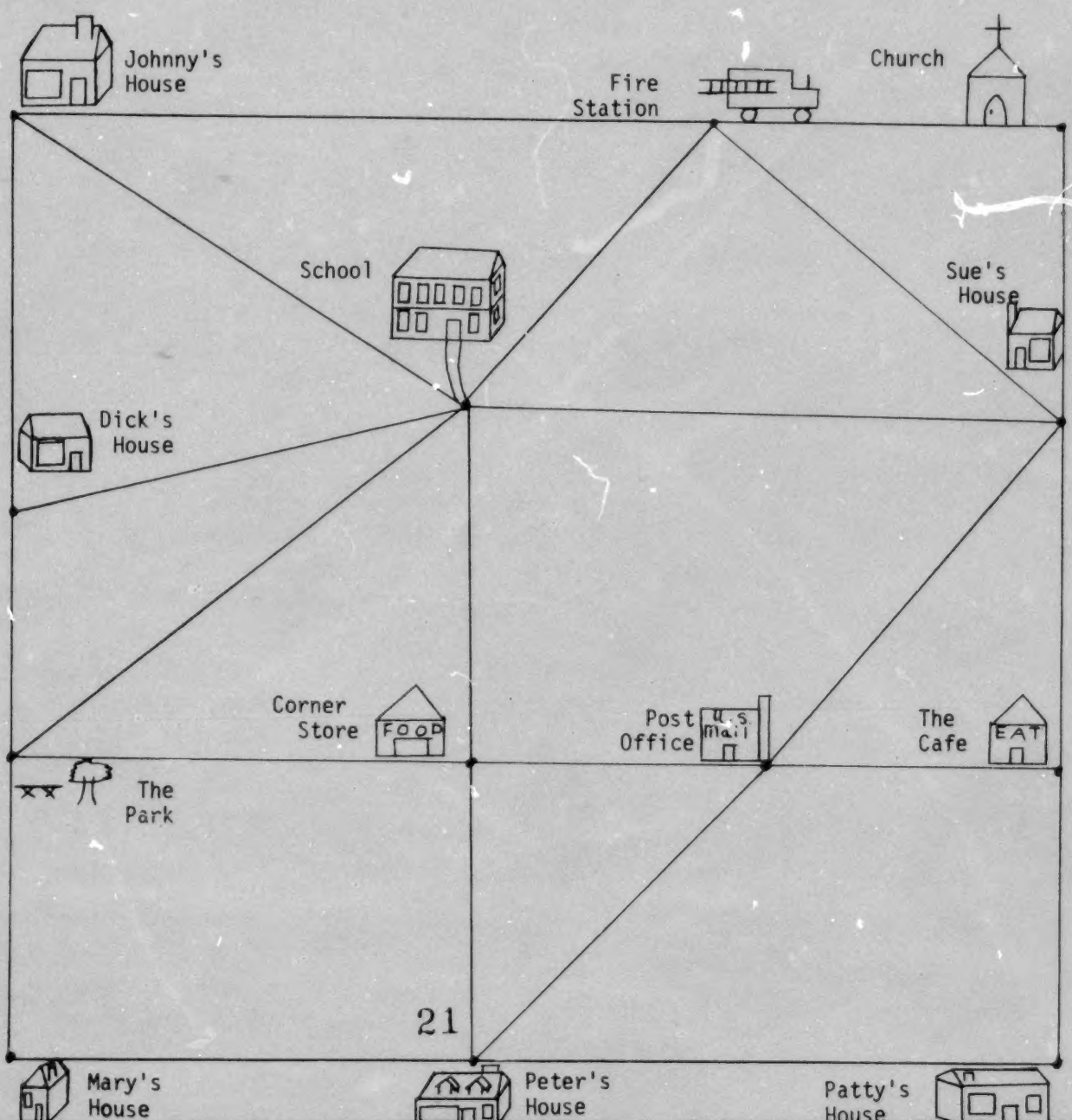
Would it make sense to have some different units for measuring the areas of different objects? Can you guess what sort of metric unit might be used to measure the area of the floor of your room? _____ Why that unit? _____

Can you guess what sort of <u>metric</u> unit might be used to measure the area covered by North Dakota? _____ Why? _____

MAP MEASURES

Johnny lives in a very small town. Below is a small drawing showing some of the places in his town. Use your metric ruler and answer the questions on the next sheet of paper about the picture. Be sure to stay on the lines that are drawn for you, when you measure.

JOHNNY'S HOME TOWN



ANSWER THE FOLLOWING QUESTIONS:

1. How many centimeters from Johnny's house to the park? _____
   How many millimeters is this? _____

2. How many centimeters from Johnny's house to the church?
   _____

3. Johnny is on his way to the park, but he has to stop at the corner store first. How many centimeters will he have to go? _____

4. Who lives the closest to the school, Johnny, Dick, or sue?
   _____

5. Johnny has to go and get the mail. How many centimeters will he have to go? _____ How many millimeters is this? _____

6. Mary and Patty are going to meet at the corner store on their way to school. How many centimeters will Mary have to go? _____ How many will Patty have to go? _____

7. How many centimeters is it from Peter's house to Sue's house? _____
   Who lives closest to the Post Office? _____

8. Johnny's family is going to eat at the cafe. First they have to stop at the school to pick up Johnny, and then they have to stop at Sue's house to get Johnny's sister. How many centimeters will they have to go before they get to the cafe? _____

9. How many centimeters do you think it is from Johnny's house to the fire station. Estimate _____ Now measure it. How far is it? _____

10. How many millimeters is it from the the post office to the Cafe? _____
    How many millimeters from the cafe to Patty's house? _____

11. How many centimeters is it from Dick's house to church going by way of the school? _____

USING A METRIC TRUNDLE WHEEL

A trundle wheel will help you measure straight lines, curved lines and many kinds of shapes that would be difficult to measure with a tape measure. The large trundle wheel that you have in your classroom is exactly 1 meter around the outside of the circle. The smaller marks are decimeters and the smallest markings are centimeters. Place the zero on the starting point and begin to roll the wheel using the handle to guide it. Count the number of "clicks" (this will tell you how many meters you have measured). When you are at the end of the distance you are measuring look at what mark is on the wheel. Add the number of centimeters or decimeters to the number of"clicks" to find the distance.

Example: 5 clicks = 5 meters

Example: 9 clicks + 35 centimeters = 9 meters 35 centimeters
OR
(935 centimeters)
OR
(9.35 meters)

1. Measure the distances that your teacher has marked off for you. Record your answers below.

   A. _____

   B. _____

   C. _____

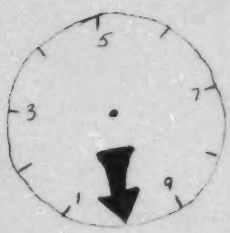
2. Take the colored tape and make a design on the floor. Mark a starting point and roll over the whole pattern, counting the "clicks" as you go. Record the answer below.

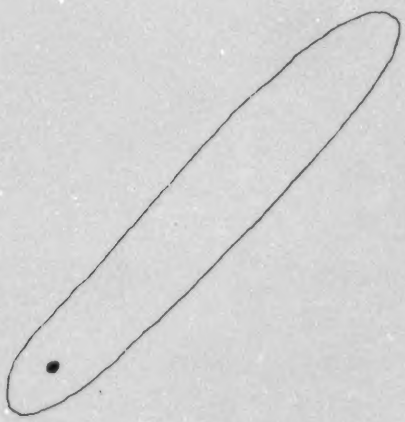
   _____ clicks + _____ centimeters =

   _____ meters _____ centimeters

3. On a sheet of paper draw a closed curve in crayon. Make a trundle with the pieces below. Cut them out and paste them to cardboard. Use a paper fastener to join them together through the black dots, keep it loose enough so that the wheel can turn. You can now measure your design in decimeters. Place the arrow on your starting point and roll it along counting the number of times the arrow touches the line again. Don't forget to check for extra centimeters at the end of the line. Record your measurements below.

The length of my closed curve was _____ decimeters + _____ centimeters.





FLOOR PLAN AREA

1. Draw a rectangle shaped shoe store with an area of 18 sq. cm. with 2 and 3 as the starting points on the centimeter grid sheet.

2. Draw a rectangle shaped clothing store with an area of 39 sq. cm. with 3 and 6 as the starting points.

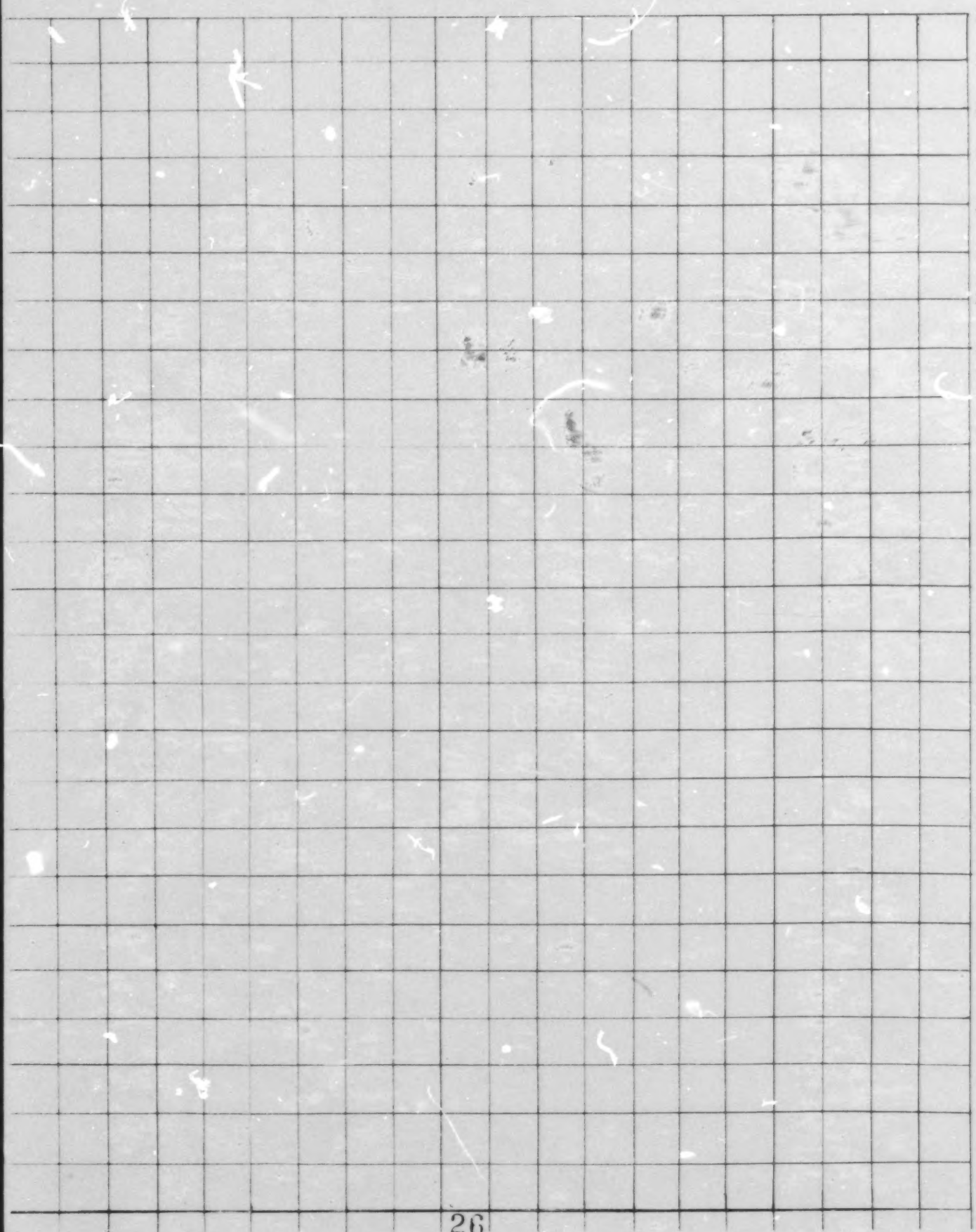
3. Draw a square shaped dimestore with an area of 49 sq. cm. with 7 and 14 as the starting points.

4. Draw a rectangle shaped drugstore with an area of 48 sq. cm. with 14 and 20 as the starting points.

5. Draw a rectangle shaped department store with an area of 60 sq. cm. with 20 and 24 as the starting points.

6. Draw a rectangle shaped hardware store with an area of 33 sq. cm. with 24 and 27 as the starting points.

7. Draw the rectangular shaped Skyline Restaurant behind the dimestore and make it 18 sq. cm. in area.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CONSTRUCTING A CENTIMETER USING A STRAIGHT EDGE, COMPASS AND 1" LENGTH

Materials: Straight edge, compass, 1" length, centimeter ruler, piece of paper.

Directions

1. Construct a line segment of any length using your straight edge. Mark two points - A and B.
2. Find the midpoint of $\overline{AB}$ and label it M.
3. Construct a perpendicular to $\overline{AB}$ at point A.
4. Using point A as center and the length of $\overline{AM}$ as radius, construct a circle using your compass placing the point of it on point A. Label the intersection of the circle and the perpendicular point P.
5. Draw a line segment connecting points P and B.
6. Construct line l parallel to $\overline{AB}$ through point Q (the intersection of the circle and $\overline{PB}$).
7. Mark off 1" on $\overline{AB}$ from point A and label it N. Then construct a line segment through points P and N.
8. The distance from the intersection of l and $\overline{PA}$ to the intersection of l and $\overline{PN}$ is 1 centimeter in length.

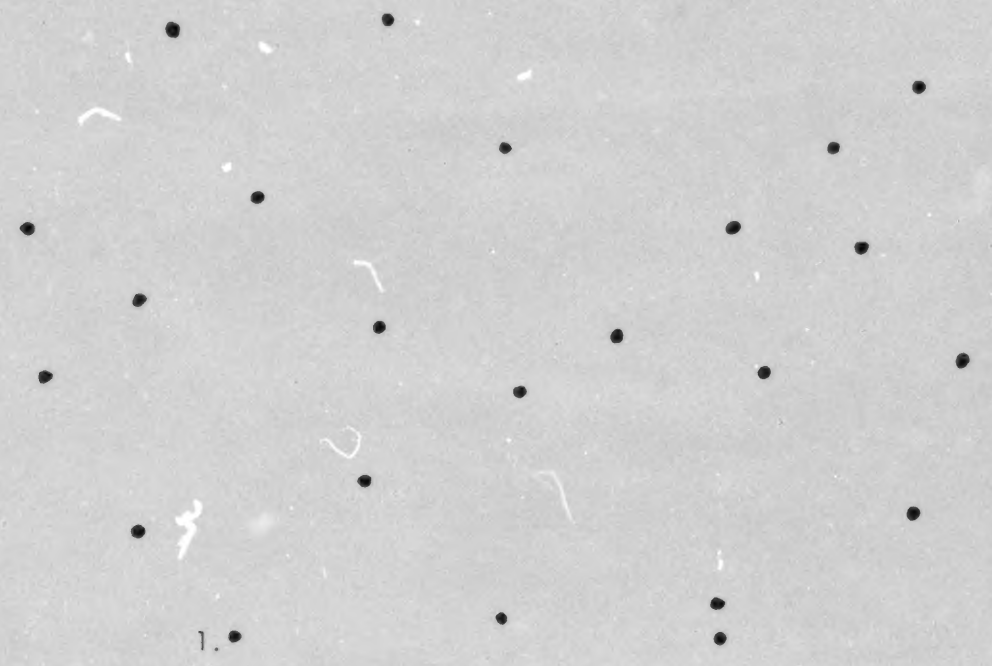
Now that you know the length of a centimeter, first estimate the length of the objects your teacher has provided to the nearest centimeter, and then measure them to the nearest centimeter to see how accurate your estimates are.

	ESTIMATE	MEASURE
1. Pencil	cm	cm
2. Paper clip	cm	cm
3. Screw	cm	cm
4. Key	cm	cm
5. Screw driver	cm	cm
6. Half dollar	cm	cm
7. Nail	cm	cm

DOT TO DOT

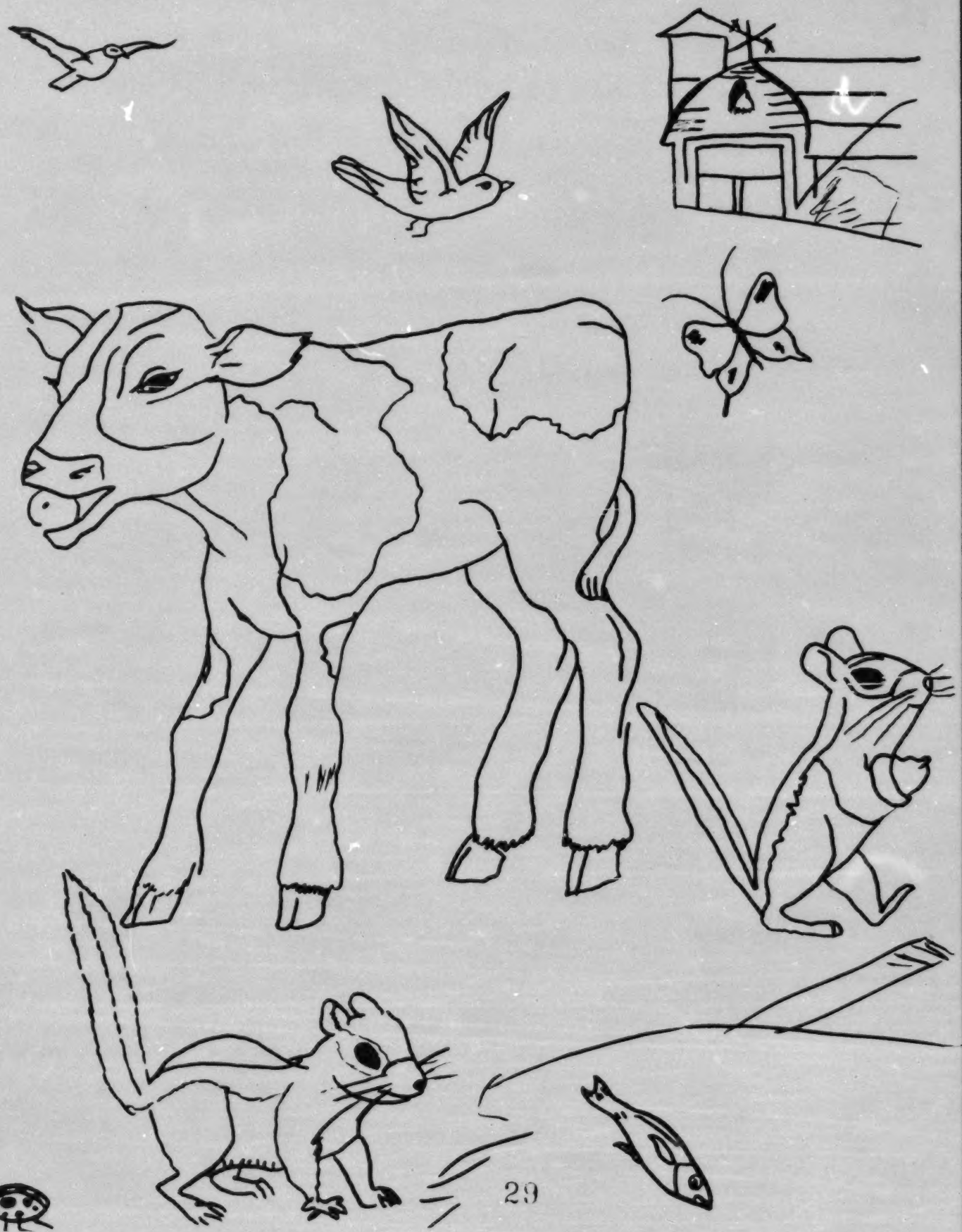
Materials: A pencil and a metric ruler with millimeter and centimeter calibrations.

Activity: Carefully follow the directions at the bottom of this page. If you do, you'll get the message!



Start at point 1.

1. Draw a line segment to the point that is 2 cm away.
2. From there go upward to a point 34mm distant.
3. Continue generally upward to a point 24 mm away.
4. Then, draw a line segment to a point 26 mm away.
5. Now, skip upward to a point 33 mm distant.
6. From there draw a line segment downward to a point 7 cm distant.
7. Next, back up 33 mm;
8. then, up 4 cm;
9. and back 23 mm.
10. Next, find a point 43 mm away and draw a line segment to it;
11. now down 6 mm;
12. then, to the left 72 mm.
13. and up 3 cm from there;
14. and finally, up 23 mm.



Use your centimeter and millimeter ruler to measure the following:

1. How long is the calf? _____centimeters
2. Measure the width of a hoof. How wide is it? _____centimeter(s)
3. How wide is the butterfly? _____millimeters
4. How wide is the barn? _____centimeters
5. How high is the barn? _____centimeters
6. How many millimeters long is the bigger bird from the tip of the tail to the tip of the beak? _____millimeters
7. What is the distance from wingtip to wingtip on the seagull? _____ centimeters
8. Measure the chipmunk's (standing on two legs) front ear. How long is it? _____centimeter(s)
9. How many millimeters long is the standing chipmunk's eye? _____millimeters.
10. How long is the tail of the chipmunk (on all fours)? _____centimeters
11. How long is the fish from the tip of the tail to the tip of the head? _____millimeters
12. How long is the ladybug? _____millimeters
13. Measure the largest dot on the lady bug. How long is it? _____millimeter
14. Measure the cap of the acorn. How long is it? _____millimeters

MEASURE PARTS OF THE BODY

Materials: Paper, pencils, metric ruler, string

Guess and Measure

Students will draw the outline of his hand and foot on the paper.

Find the measurement of the perimeter of the foot and the hand. Use the string.

With the same piece of string, measure your (1) head, (2) ankle, (3) wrist, (4) neck, (5) waist.

OBJECT	Guess	Answer
1. Foot		
2. Hand		
3. Head		
4. Ankle		
5. Wrist		
6. Neck		
7. Waist		

Compare your answers with a partner.

ESTIMATING AND MEASURING YOUR SCHOOL

Using a centimeter ruler estimate the following and then find the actual measurement.

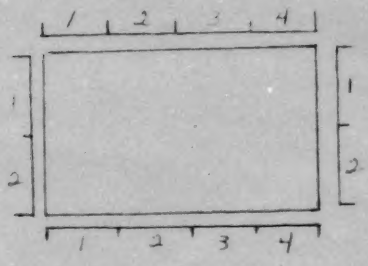
OBJECT	ESTIMATE	ANSWER
1. Desk top length		
2. Length of pencil		
3. Longest piece of hair		
4. Side of a book		
5. Sheet of paper		

Estimate the following, then using a meter stick find the actual measurement.

	ESTIMATE	ANSWER
1. Gym length		
2. Gym width		
3. Counter in kitchen		
4. Stage length		
5. Stage width		
6. Blackboard width		
7. Blackboard height		

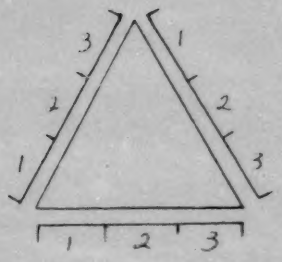
PERIMETER

Perimeter is the measure around the figure.



2 + 4 + 2 + 4 = 10cm

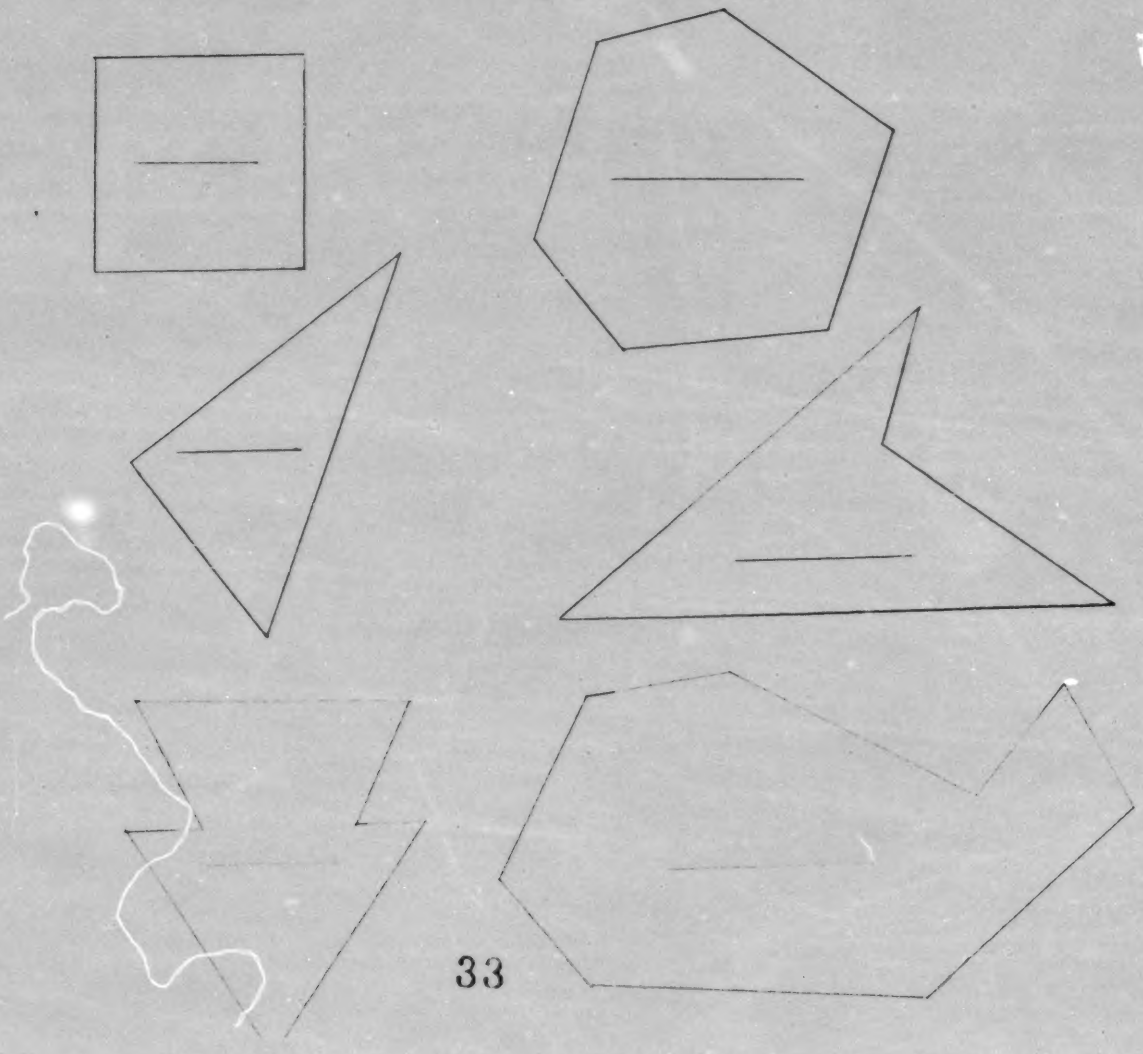
The perimeter is 10cm



3 + 3 + 3 = 9cm

The perimeter is 9cm

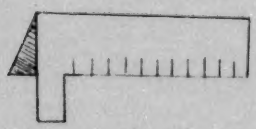
Find the perimeters of these figures:



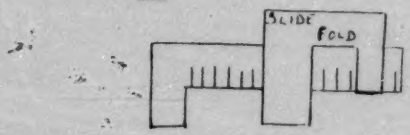
MAKING A CALIPER

Constructing the Metric Caliper:

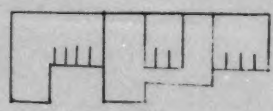
Carefully cut out the slide and scale on the next page.
Fold the scale as shown.



Insert the scale through the slits cut in the slide.



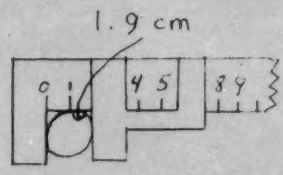
Fold slide along fold line so slide fits snug on scale.



To measure the thickness of an object with the Metric Caliper

Fit object between leg on scale and slide. Push slide until object fits snug.

Read measure on scale using edge of slide.

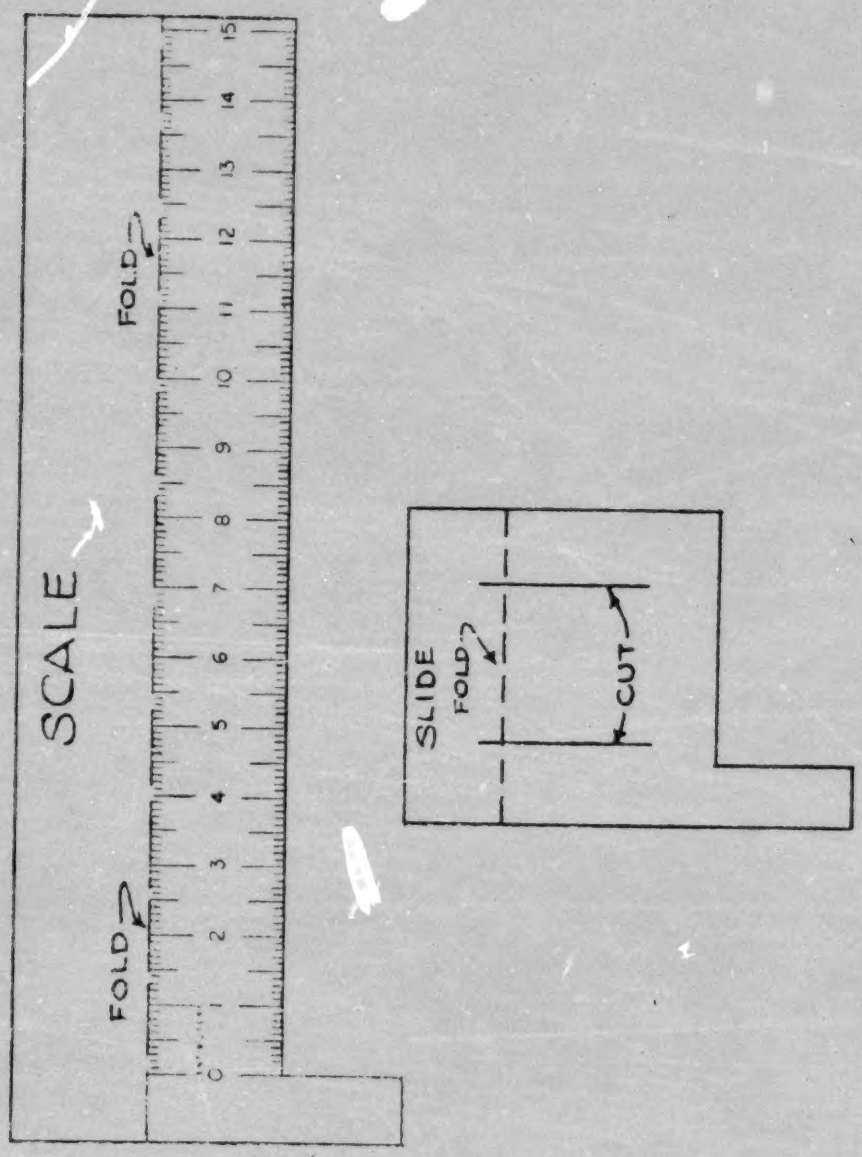


USING THE CALIPER:

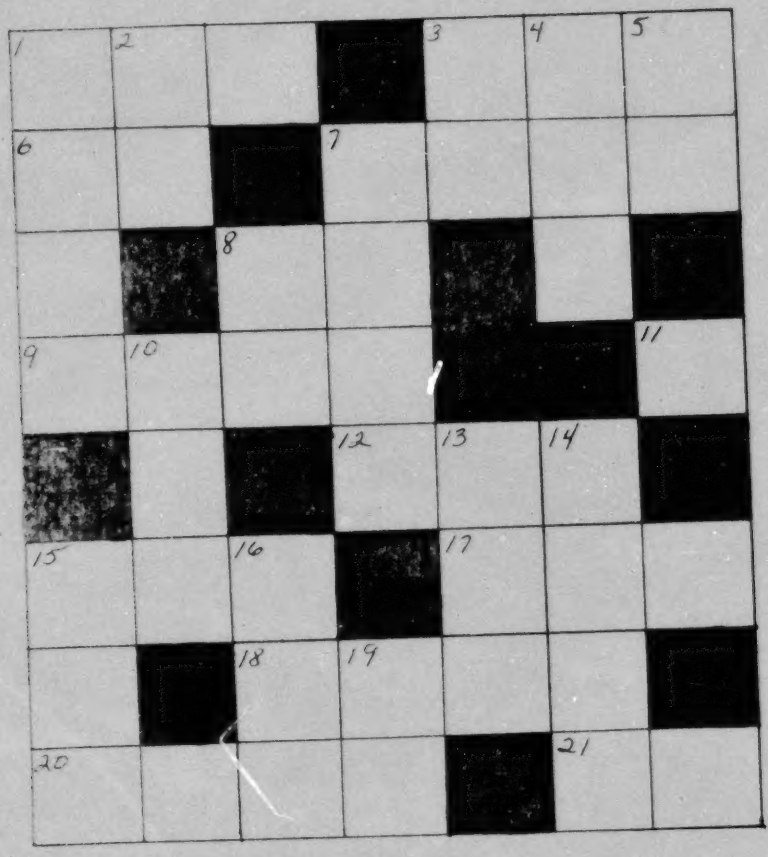
Estimate the thickness or width of each object listed to the nearest tenth of a centimeter then measure using the Metric Caliper. In the "Error" column place a + sign in front of errors resulting from estimates larger than actual measures and a - sign in front of errors if the estimate is smaller than actual measures.

OBJECT	Estimate	Measure	Error
Width of pencil			
Width of finger			
Thickness of textbook			
Diameter of piece of chalk			
Width of paper clip			
Thickness of desk top			
Width of palm of hand			
Width of chalkboard eraser			
Diameter of chair leg			

METRIC CALIPER



A METRIC PUZZLE



ACROSS

1. 4.2m = ____cm
3. 7hm + 65m = ____m
6. 1dm + 14cm = ____cm
7. 3km + 521m = ____m
8. 480mm = ____cm
9. 8m + 221mm = ____mm
11. 6000m = ____km
12. 57.5cm = ____mm
15. 8hm + 4dkm + 5m = ____m
17. 12.6m = ____dm
18. 184km x 16km = ____km^2
20. 1m = ____mm
21. 3m x 3m x 3m = ____m^3

DOWN

1. 4km + 218m = ____m
2. 6cm x 4cm = ____cm^2
3. 7dm + 5cm = ____cm
4. .624m = ____mm
5. 5m + 1dm = ____dm
7. 3m + 315mm = ____mm
8. .42m = ____cm
10. 2m + 3dm + 4cm = ____cm
11. 60m = ____dkm
13. 7m + 1dm + 4cm = ____cm
14. 5m + 2dm + 4cm + 2mm = ____mm
15. 86dm + 1cm = ____cm
16. 52dm = ____cm
19. 9dkm = ____m

METRIC BASEBALL THROW

(This is a seasonal activity. In October and November try a football pass.)

In succession, each student will throw a baseball as far as he or she possibly can from home plate. Each pupil will be allowed two tries. The most distant of the two will be recorded by the scorekeeper. Five pupils must be present in the outfield while the throws are being tossed. A rotation system may be devised so that everyone gets equal time being an outfielder. After the contestant throws the ball, the closest outfielder should stand on the spot where the ball drops. Four students should be designated linepersons. They will be equipped preferably with metric steel tapes. Measure to the nearest centimeter, the distance from home plate to the location where the ball drops. Any ball landing in foul territory will not be measured. A method for the rotation of linepersons may also be devised.

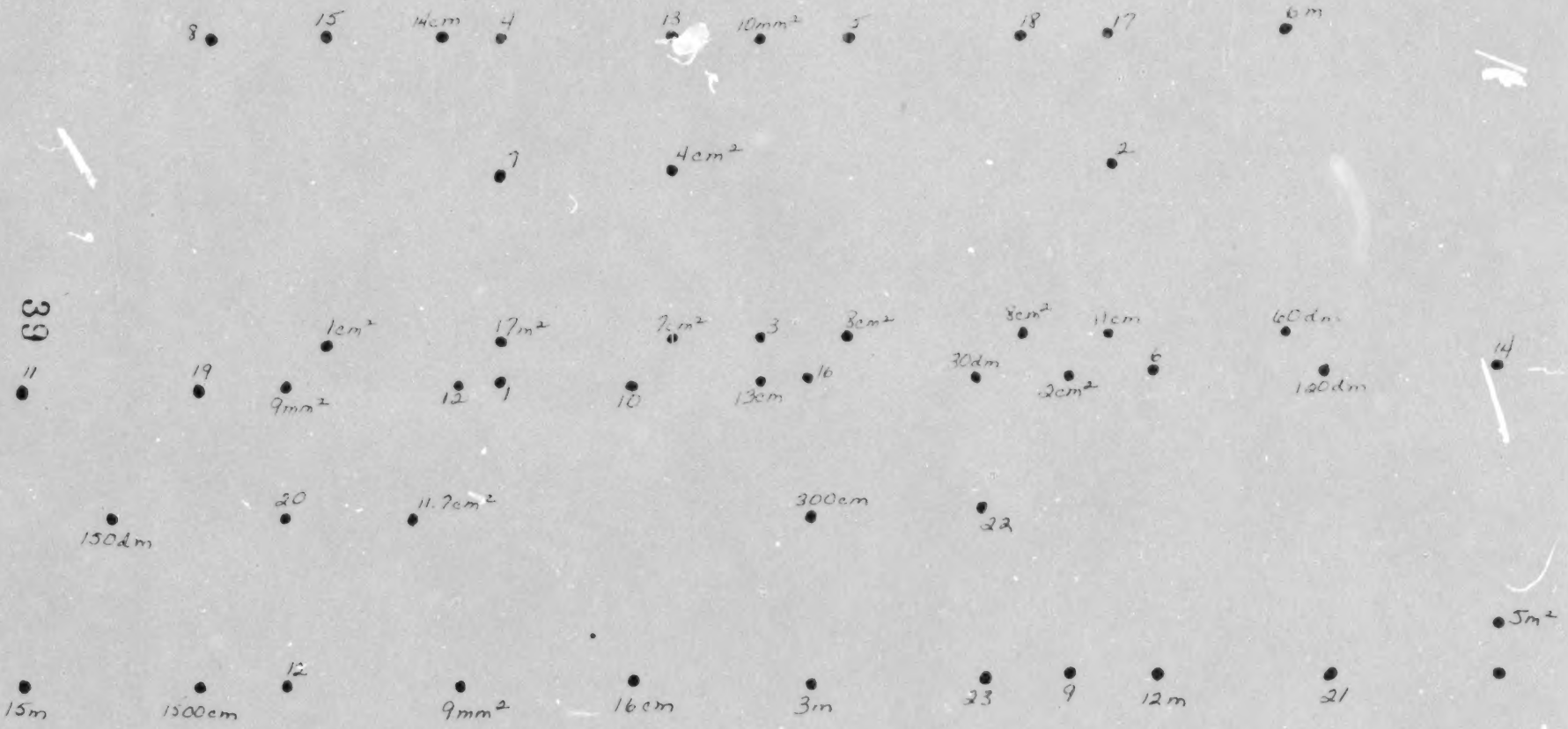
NAME	MON.	TUES.	WED.	THUR.	FRI.	AVERAGE

Try this activity everyday for one week. At the end of the week each student will find his average to the nearest centimeter. Find the class average.

AREA OR PERIMETER ACTIVITIES

Find the area or perimeter from the data given and fill in the answer in the unit asked for. After the answer is found, use the number of the problem and the answer to connect a line segment to the two on the grid below to form the MUST words on the following page.

1. rectangle: L=45mm; W=20mm — perimeter=____cm
2. square: S=150cm — perimeter=____m
3. rectangle: L=50mm; W=2m — area=____mm^2
4. triangle: B=17m; A=2m — area=____m^2
5. rectangle: L=4cm; W=2cm — area=____cm^2
6. triangle: S1=2m; S2=7m; S3=3m — perimeter=____m
7. rectangle: L=8cm; W=.5cm — area=____cm^2
8. square: S=35mm — perimeter=____cm
9. parallelogram: B=.4cm; A=5cm — area=____cm^2
10. rectangle: L=55mm; W=25mm — perimeter=____cm
11. square: S=375cm — perimeter=____m
12. triangle: B=6mm; A=3mm — area=____mm^2
13. rectangle: L=2.5cm; W=2.8cm — area=____cm^2
14. parallelogram: B=2.5m; A=2m — area=____m^2
15. square: S=1cm — area=____cm^2
16. triangle: S1=98cm; S2=86cm; S3=116cm — perimeter=____m
17. rectangle: L=29mm; W=26mm — perimeter=____cm
18. parallelogram: B=2.5cm; A=3.2cm — area=____cm^2
19. triangle: S1=4,500mm; S2=6,900mm; S3=3,600mm — perimeter=____cm
20. rectangle: L=6.5cm; W=1.8cm — area=____cm^2
21. square: S=300cm — perimeter=____m
22. triangle: S1=120cm; S2=149cm; S3=31cm — perimeter=____cm
23. square: S=75cm — perimeter=____cm


8
15
14cm
4
13
10mm²
5
18
17
6m
7
4cm²
2
39
1cm²
17m²
7m²
3
3cm²
8cm²
11cm
60dm
11
19
9mm²
12
1
10
13cm
16
30dm
2cm²
5
120dm
14
20
11.7cm²
300cm
22
150dm
5m²
12
15m
1500cm
9mm²
16cm
3m
23
9
12m
21

AREA

Materials: Construction paper, paste or tape, scissors, meter stick

Procedure: 1) Children will work in small groups. Using the construction paper have the groups construct a number of square centimeters, square decimeters, and square meters.

2) Using their constructed units of area have children measure the surface areas of such things as the blackboard, desk or table tops, floor, windows, books, or other articles you may have in the classroom. Have each group measure each area with each unit of measure they have constructed. Have students tabulate their results in a table such as the one that follows. Let groups compare answers.

OBJECT	Area in cm^3	Area in dm^3	Area in m^3
1)			
2)			
3)			

Discussion: What unit worked best for measuring the area of the blackboard? the floor? the desk or table tops? What unit of area works best for measuring small areas? for measuring larger areas?

TRUNDLE WHEEL

Materials: Trundle wheel, metric stick, cloth metric tape, steel metric tape

Instructions for the Teacher: The children should be divided into four groups. Each group will go to the different stations to do their activity.

Using the trundle wheel, measure the following items and record your answers in the following blanks.

A. the length of the hall outside our room _____ meters

B. the width of the hall outside our room _____ meters

Using the metric stick, measure the following objects and record your answer.

A. frame of the box that encloses the fire extinguisher _____ width in cm.
_____ length in cm.

B. width of the display case by the principal's office _____ width in cm.

C. height of the door frame of our room _____ cm. high

Measure the following parts of the teacher with a cloth metric tape.

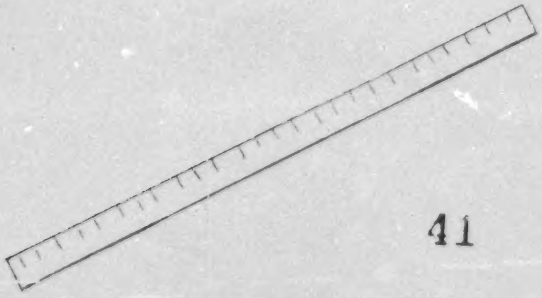
A. foot _____ cm _____ mm
B. hand _____ cm _____ mm
C. arm span _____ cm _____ mm

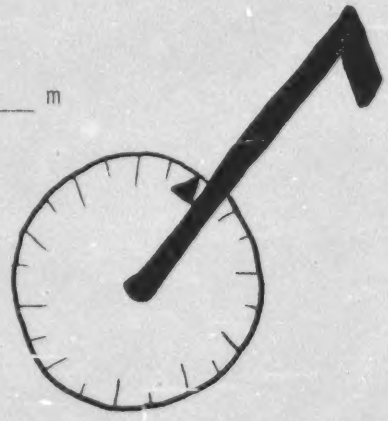
cm = centimeter
mm = millimeter
m = meter

Measure the following school equipment with a steel metric measuring tape.

A. width of the bike rack _____ cm _____ m

B. length of the teeter totter board _____ cm _____ m





VOLUME
AND
CAPACITY

EXPLORING VOLUME...INCLUDING CONSERVATION AND INVARIANCE

Using many different containers, allow free play for several days before the following exercise.

Material: 4 cups of equal size, 1 small jar, 1 small bottle, 2 cans; 1 small and 1 large milk carton (qt. size), small bucket, funnel and water.

*Teacher or delegated student records findings on board.

Oral directions: Using the different containers see if you can find:

1. How many cupfuls fill the milk carton
2. How many cupfuls fill the small can
3. How many small canfuls fill the milk carton

Discuss findings

4. How many milk cartonfuls fill the bucket
5. How many milk cartonfuls you can fill with a full bucket
6. Fill the milk carton, pour it into the cups until it is all gone. How many cups does it fill? Now pour all the cupfuls back into the milk carton.

Discuss findings

* (Make certain that the large can along with the milk carton will completely fill the bucket.)

7. Fill the bucket, pour enough into the milk carton to fill it and the rest into the can. Now pour the water from both the milk carton and the can back into the bucket. What do you find?

* (Have jar, small can and bottle equal in volume.)

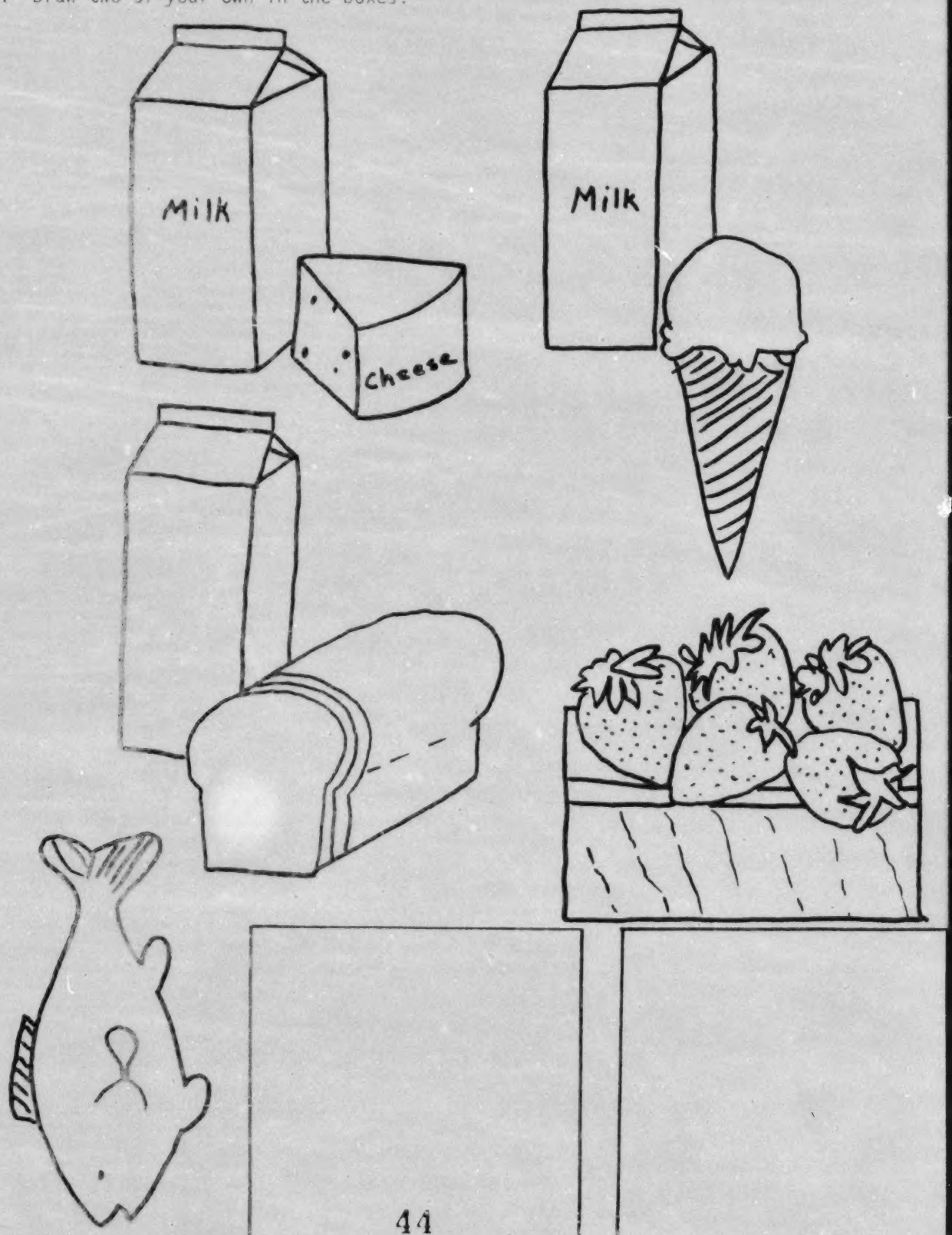
8. Fill the jar, pour it into the small can. What do you find?
   Pour the canful into the bottle. What happens?
   Pour the bottleful into the jar. What do you discover?

Discuss findings

* = Teacher Note

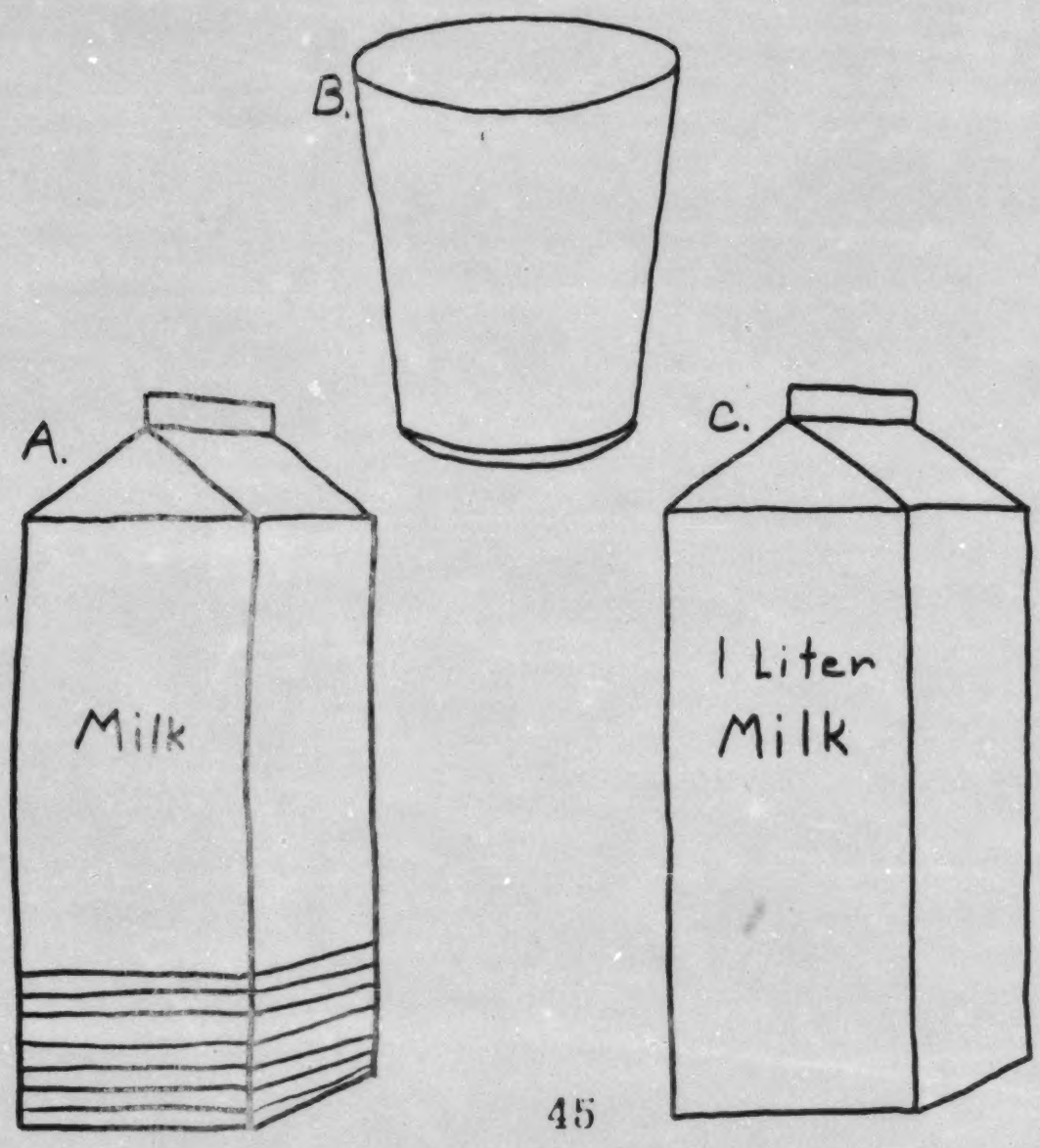
MEASURING WITH A LITER

1. Circle the things we measure by the liter.
2. Draw two of your own in the boxes.



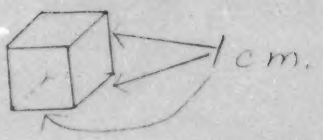
Questions by the teacher:

1. Do each of the following containers represent a liter measure?
2. If we pour the milk from A and it fills B and empties A what part of a liter does B hold?
3. Which container holds more, B or C?
4. Which container holds less, B or C?



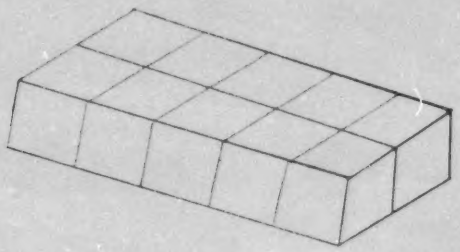
CENTIMETER CUBES

This is a centimeter cube.



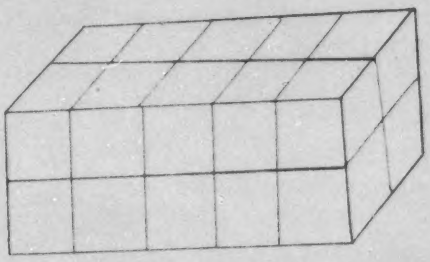
How many centimeter cubes can you count in this solid? _____

(1)



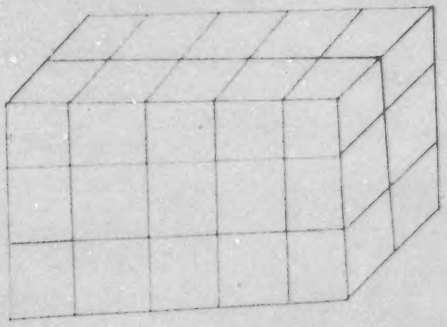
If you place two of these solids on top of each other, how many centimeter cubes do you get? _____

(2)



Now place three of these solids, in 1 above, on top of each other. How many centimeter cubes are there? _____

(3)



You are finding the volume of these solids.

You can write centimeter cubes as cm^3.

Write the volumes of the solids in the following chart.

1.	cm^3
2.	cm^3
3.	cm^3

VOLUME

Materials: Wheat for dry measure, pop cans, shoe boxes, ice cream pails, coffee cans, cereal boxes, milk cartons.

Determine the number of handfuls of grain it takes to fill the following items (use one of your own hands).

1 pop can = _____ handfuls

1 shoe box = _____ handfuls

1 ice cream pail = _____ handfuls

1 coffee can = _____ handfuls

1 cereal box = _____ handfuls

1 milk carton = _____ handfuls

Do your amounts agree with those of your classmates? Why or why not?

In groups of 2 or 3 determine the number of pop cans full of grain there are in the following items.

1 shoe box = _____ pop cans

1 ice cream pail = _____ pop cans

1 coffee can = _____ pop cans

1 cereal box = _____ pop cans

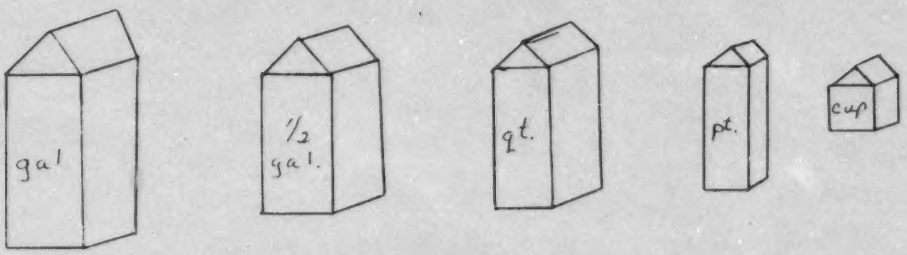
1 milk carton = _____ pop cans

Is it easier to compare measures if every one uses the same size unit to measure?

VOLUME - SIZING CONTAINERS

Materials: Containers of various sizes, dry measure medium (wheat or sand).

Place the following containers in the order from smallest to largest - (milk cartons)

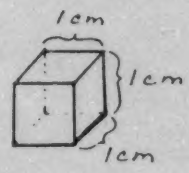


After placing in order use the standard measuring cup - 1 ℓ measure and sand or grain - to find out if you are correct. Record your findings in the chart.

Size	Guess Container Order	Actual Container Order
largest		
large		
medium		
small		
smallest		

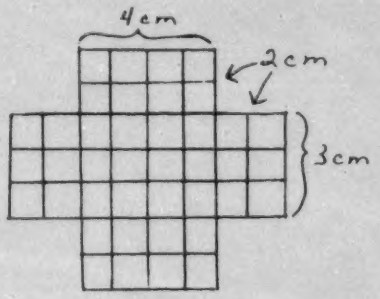
CUBIC CENTIMETERS FOR MEASURING SMALL VOLUMES

Materials: Cuisenaire rods, centimeter squared paper, scissors, rulers, sticky tape, sand (about 1 ℓ per 3 students), 5 cc spoons (teaspoons will do), various shapes and sizes of small containers.



1. Find a unit rod (W). Measure the rod with your ruler. You should discover that the rod is 1 cm long, 1 cm wide and 1 cm high. The space that 1 unit rod takes up is 1 CUBIC CENTIMETER. A shorter way to write cubic centimeters is either cc or cm^3. Cubic centimeters are used to measure fairly small volumes. For instance, medicine is usually measured in cc's. You may find it useful to have a personal measurement for a cubic centimeter. One good measurement is the end of your finger. Try it. Which of your fingers makes the best cubic centimeter? _____

2. On centimeter squared paper draw an outline like the one below with dimensions as indicated on the drawing:



3. Cut out the figure. Fold the flaps up and tape the edges together so you have a little box.

4. Without using the rods but using one unit rod for comparison, try to guess how many unit rods will exactly fit inside your box. _____ rods. Now use the unit rods and exactly fill your box with them. How many rods did you use? _____ rods. Was that pretty close to your guess? During this lab you will get some practice guessing volumes. If you used _____ unit rods to fill the box, that means the box takes _____ cm^3 to fill it. Hold the rods in your hand to get an idea of that amount of volume. Can you close your hand, or are there too many rods? How many rods make a handful? _____ This is how many cm^3? _____ cm^3.

5. A rounded teaspoon of sand is about 5 cm^3 in volume. Exactly fill up your box with sand, keeping count of how many spoonfuls of sand you use. Fill the box level with the top. How many spoonfuls of sand did you need? _____
To get the volume of the box, multiply the number of spoonfuls by 5.
_____ spoonfuls times 5 equals _____ cm^3. You should have used about 5 spoonfuls of sand, and the volume should be close to the volume you got by filling the box with unit rods.

6. Using at least 4 other containers, first guess how many cm^3 each will hold. Then fill the container with spoonfuls of sand to find out how many cm^3 it holds. Record your data below:

OBJECT	ESTIMATED VOLUME	SPOONFULS OF SAND NEEDED	VOLUME IN cm^3

LITERS

Materials: Teacher should bring different containers from home such as glasses, cans, square containers, etc. There should be a number on each container. There should be available 3 or 4 graduated beakers and about a bushel of dry measure of some type (example - wheat). Water may be used if teacher finds it convenient. Children should work in pairs, 6 or 8 at a time working out the table below.

Student Directions: First of all, look at the container and the number that is on it. Then guess how many milliliters or liters that the container contains. Put your guess on the first line and then measure it using the beaker and see how close you were. Fill in the table

Container	Guess	Measure
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____

DO THESE STORY PROBLEMS BEFORE IT IS YOUR TURN OR WHEN YOU ARE FINISHED.

1. Betty had 1 liter of water in her pail. Susan had 500 milliliters of water in her pail. How many milliliters of water did the two girls have together?
   _____

2. Mary has 40 milliliters of orange juice and Patty has 60 milliliters of orange juice. How many milliliters do the two girls have together? _____
   How many deciliters is this?_____

3. John has 28 liters of gas in his tank. Jim has 45 liters of gas in his tank. How many more liters does Jim have than John? _____ How many centiliters is this? _____

4. Mrs. Brown was making a cake that called for 5 milliliters of soda, 5 milliliters of salt, 250 ml of milk, 250 ml of sugar and 750 ml of flour. How many milliliters is this all together? _____ How many liters? _____

HIDDEN WORD PUZZLE

Circle the metric, measurement, and shape words found in the puzzle.

D A E R Y K N Z A W P N
C I R C L E I S H A P E
F O R N O M A K T T O L
C E N T I I M E T E X N
M U K T C L I T E R D Y
N E O K A L I Q U I D L
C O T M O I Y P Z F E E
E K A E P L N M A Z C P
G I N A E I M E G A I G
V L O S R T A T R Y L E
V O L U M E A E A D I E
P E T R T R K I M A T N
I K R E C T A N G L E T
M O R N Y D K E T K R A

DISPLACEMENT

Materials: Displacement pail
Water
3 - 500 ml articles of different shapes that do not float
2 - 400 ml articles of different shapes that do not float
2 - 1 ℓ articles of different shapes that do not float
A few miscellaneous articles - does not matter if they float
All of the above articles should be of different weights so that the children realize that the objects do not have to weigh the same in order to have the same volume. Also, these articles can be made out of milk cartons, potato chip cans, pop cans, etc. with rocks or something heavy in them.

1. Fill the pail with water to the bottom edge of the spout and place a catch can under the spout. Let some water run through to make sure it is to the bottom of the spout.
2. First have the children try and guess which of the articles have the same volumes between the 500 ml, 400 ml, and 1 ℓ ones. They could also make an estimate of the volumes.
3. Have them measure the volume of each one by placing it in the displacement pail and measuring the amount of water that comes out.
4. Did they guess right? Have them group the articles according to volume and point out that they do not have to have the same shape to have the same volume.
5. Let them measure the volumes of other miscellaneous articles for practice in finding volumes by the water displacement method. This is also a good time for them to practice using metric units for measuring.

EQUIVALENT VOLUMES

Find the equivalent volumes that name a tic-tac-toe.

1 ℓ	1000 cm^3	1 dm^3
1 cm^3	2 cm^3	4 ml
1 ℓ	10 dm^3	10,000 cm^3

100 hm^3	100 cm^3	1 m^3
100 mm^3	10 km^3	1000 dm^3
1000 ml	100 ℓ	1,000,000 cm^3

1 ℓ	10 ml	1 cm^3
1 cm^3	.001 ℓ	.01 dℓ
1 ml	10 cm^3	1 dm^3

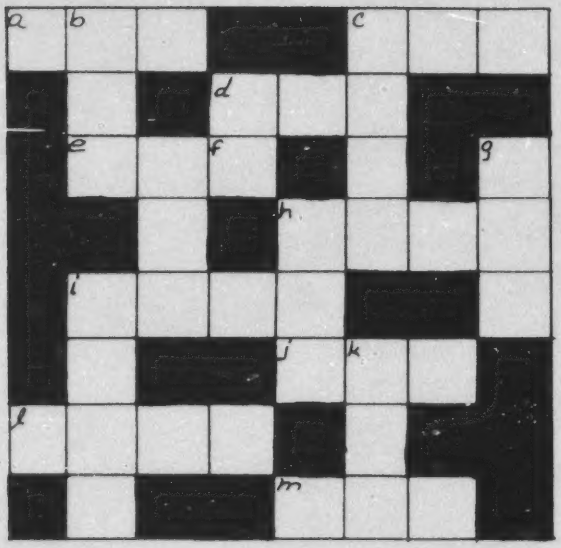
1 ℓ	1 cm^3	1 dm^3
100 ℓ	1000 ml	10 ℓ
100 cm^3	1 ℓ	10 dl

1.25 cm^3	12.5 cm^3	125 dl
125 cm^3	.125 ℓ	.25 ml
12.5 dm^3	1250 cm^3	1.25 ℓ

50 ℓ	5000 ml	500 cl
500 dl	50 dl	5 dl
5 dal	500 cl	50 ml

CROSS-NUMBER PUZZLE

Converting from one metric unit of liquid to another, complete the cross-number puzzle using the clues below.



Down

b. 800 dl + 9600 cl = ____ ℓ
c. 2 ℓ + 11.57 dl = ____ ml
d. 300 dl + 1500 cl = ____ ℓ
f. 3 ℓ + 11.7 dl = ____ cl
g. 0.26 ℓ + 1.3 cl = ____ ml
h. 1.2 dl + 0.121 ℓ = ____ ml
i. 50 ℓ + 1680 ml = ____ cl
k. 6000 dl + 3800 cl = ____ ℓ

Across

a. 2 dl + 11.4 cl = ____ ml
c. 4 ℓ - 30 ml = ____ cl
d. 400 ℓ + 81,000 ml = ____ ℓ
e. 64 ℓ + 50 cl = ____ dl
h. 2.7 ℓ + 4.7 cl = ____ ml
i. 57 ℓ + 240 ml = ____ cl
j. 100,000 ml + 6500 cl = ____ ℓ
l. 3 ℓ + 16.27 dl = ____ ml
m. 0.15 ℓ + 13.7 cl = ____ ml

METRIC RECIPES

Materials: A measuring cup for liters and milliliters, measuring spoons for milliliters, mixing bowl

Drop Biscuits

480 ml flour
15 ml baking powder
5 ml salt
60 ml shortening
180 ml milk

Mix flour, baking powder and salt. Add shortening and mix well. Mix in milk. Drop by spoonfuls on a greased baking pan. Bake at 210°C, 10 to 12 minutes or until lightly brown. Makes about 12 biscuits.

Sugar Cookies

480 ml sugar
240 ml butter
240 ml sour cream
3 eggs
5 ml soda
960 ml flour
5 ml vanilla

Mix. Place on cookie sheet (greased). Bake at 175°C about 10 minutes. Makes about four dozen.

VOLUME

Materials: Cup, jar, trash can, cuisenaire rods, paper and pencils.

I. Guess the volume of these objects:

Object	Guess	Acutal
cup		
classroom		
jar		
trash can		
sink		
book shelf		

II. What is the most common cubic measure in the metric system?

_____

III.

1. Use the cuisenaire rods to build a staircase 10 steps high.

   Volume of your staircase is _____.

2. Use the cuisenaire rods. Build a one story home.

   The volume of your home is _____.

3. Use the cuisenaire rods and build a fence.

   The volume of your fence is _____.

4. Use the cuisenaire rods to measure the volume of your math book.

   The volume of your math book is _____.

METRIC OATMEAL COOKIES

	Volume
Sugar	600 ml
Butter	120 ml
Salt	.3 ml
Cocoa	60 ml
Milk	120 ml
Peanut butter	120 ml
Rolled Oats	800 ml
Vanilla	5 ml

Measure first five ingredients into large pan. Heat and stir until sugar dissolves. Continue to stir until boiling. Let boil 30 seconds. Remove from heat. Stir in peanut butter, oats, and vanilla. Mix well. Quickly spoon on waxed paper. Cool. Makes 50.

METRIC HAYSTACKS

	Volume	Weight
Butterscotch Morsels	450 ml	350 g
Chow Mein Noodles	400 ml	90 g
Salted Peanuts	250 ml	140 g

Melt butterscotch morsels. Stir in chow mein noodles and peanuts. Drop by teaspoonfuls on waxed paper. Let stand until set, approximately 20 minutes. Makes 40.

CAPACITY

The volume of a container tells you two things:

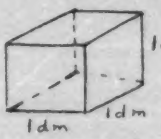
1. the amount of space inside
2. the amount it will hold

Capacity is the amount a container will hold.

Capacity can be given in units of liquid (ℓ) or in cubic units.

$1\ dm^3 = 1\ \ell$ (liter)

The capacity of 1 cubic decimeter is 1 liter.



1 cubic decimeter ($1\ dm^3$)

Using a liter cup, a quart container, a gallon container, and wheat, answer these questions.

1. Which is larger, 1 quart or 1 liter? _____
2. Could you put 1 liter of wheat into a quart container? _____
3. Could you put 1 quart of wheat into a liter container? _____
4. Could you put 4 liters of wheat into a gallon container? _____
5. Could you put 1 gallon of wheat into a 4 liter container? _____

Complete the following table:

1 kiloliter (kl) = _____ liters

1 hectoliter (hl) = _____ liters

1 dekaliter (dal) = _____ liters

1 deciliter (dl) = _____ liter

1 centiliter (cl) = _____ liter

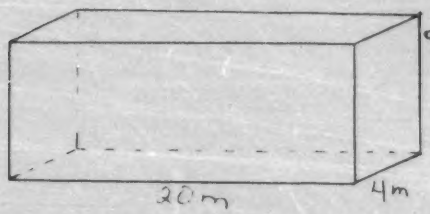
1 milliliter (ml) = _____ liter

WRITTEN PROBLEMS

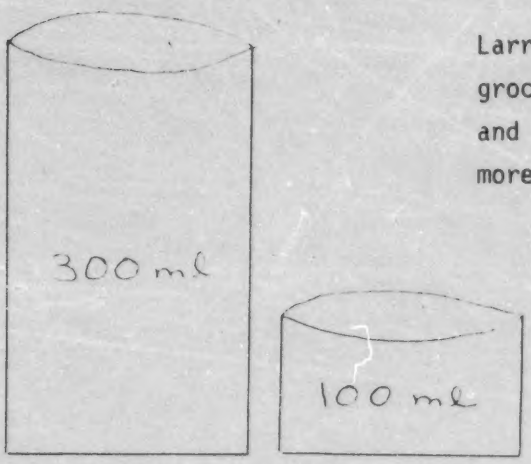
1. Larry bought 6 liters of oil for his car. He paid $3.54 for the oil. How much did he pay for each liter? _____

2. If there are 10 milliliters of cough medicine in a bottle (small size), how many small sized bottles can be filled from a 1 liter bottle of medicine? _____ bottles

3. My car holds 60 liters of gasoline and can travel 12 kilometers on a liter of gas. How far can it travel on a full tank of gas? _____ km

4. 

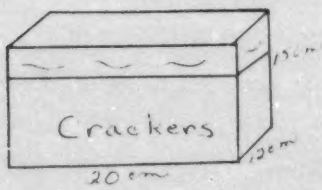
If I dug a hole in the ground with the following dimensions, what is the volume of earth removed? _____ m^3

5. 

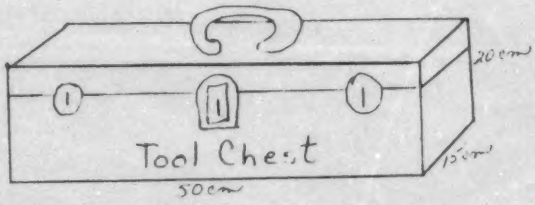
Larry compared two cans of orange juice in a grocery store. A 300 ml can sold for $.60 and a 100 ml can sold for $.22. Which was more economical? _____ ml can

FINDING THE VOLUME

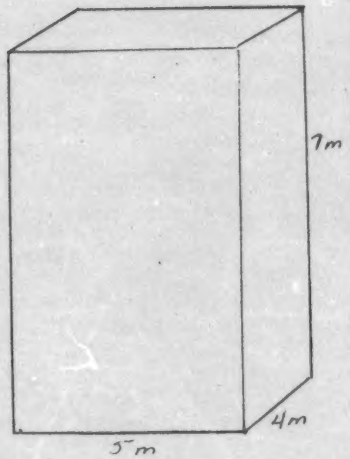
Use the given dimensions to find the volume of each object.



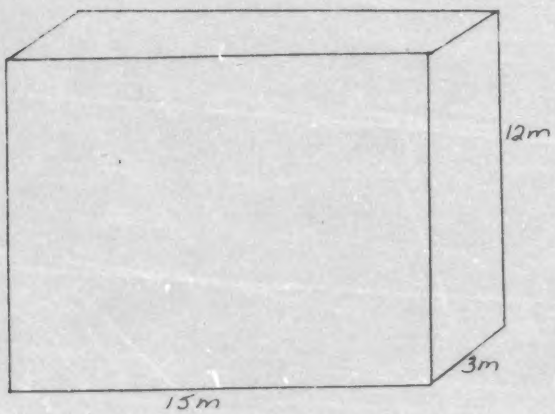
a. _____ cm^3



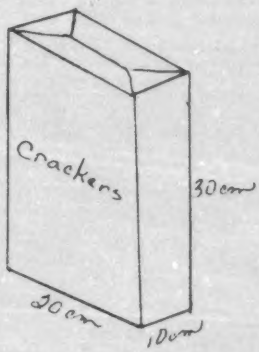
b. _____ cm^3



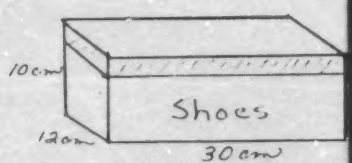
c. _____



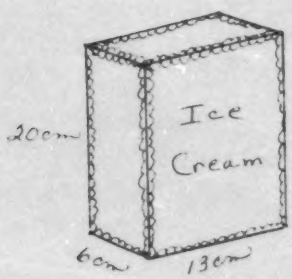
d. _____ m^3



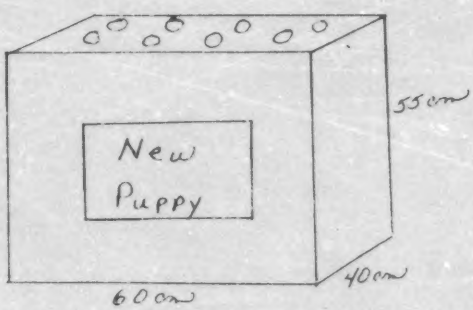
e. _____



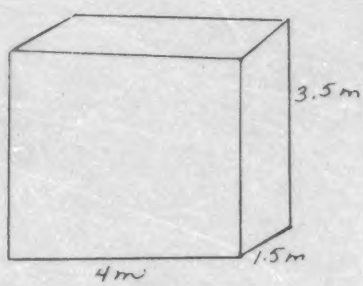
f. _____



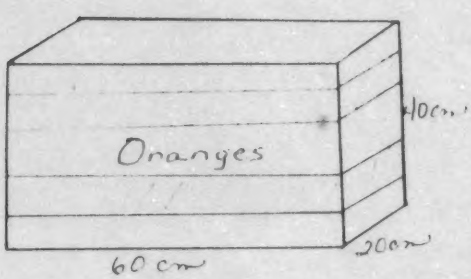
g. _____ cm^3



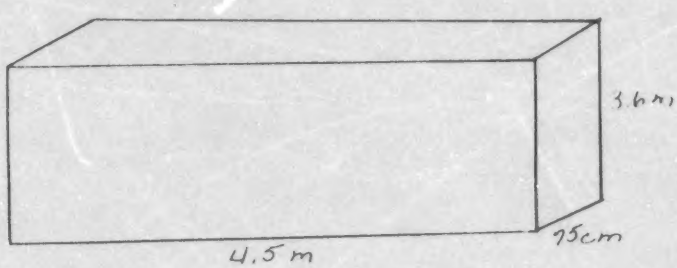
h. _____



i. _____



j.



k.

COOK ALA METRIC

Materials: The equipment needed for this activity includes graduated milliliter pitchers, milliliter spoon sets, English spoon sets, English measuring cups, hot plates, and the ingredients and materials called for in the recipe.

Convert the following recipe to the metric system. To accomplish this task, transfer the volume in the English system containers to the metric devices. Record the measurements. (If you are not going to try the recipe, you may use sand or another usable material to find the conversion.)

CANDIED POPCORN

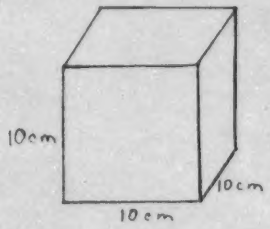
1 cup sugar	_____ ml of sugar
1/2 cup molasses	_____ ml of molasses
1 tablespoon of soft butter	_____ ml of soft butter
1 tablespoon of cider vinegar	_____ ml of cider vinegar
1/4 teaspoon of baking soda	_____ ml of baking soda
1 cup popcorn	_____ ml of popcorn

TRY IT OUT. Butter a 39 cm by 28 cm jelly roll pan and a large bowl. Pop the popcorn. Place 1/2 of it in the large buttered bowl and save the rest. In a heavy saucepan, over medium heat, cook the sugar, molasses, butter and vinegar until a small amount of the mixture forms a firm ball in very cold water. With a spoon, beat the baking soda into the molasses mixture until well combined. Pour 1/2 of the mixture into the large buttered bowl with the popcorn. Stir quickly until the popcorn is coated. With buttered hands, spread mixture onto 1/2 of the jelly roll pan. Repeat with the remaining popcorn and molasses mixture. Cool. Break it into pieces. HOW DOES IT TASTE!

CAPACITY

Get a half-gallon carton. The length and width are approximately 10cm. Cut down the carton so that the height is also 10cm. The volume of the container is now ____ cm^3.

10 cm = ____ dm. The volume in dm^3 is ____ dm^3 because the volume of a rectangular solid is V = LxWxH so the volume of the carton is ____ cm x ____ cm x ____ cm or ____ cm^3 or ____ dm^3.

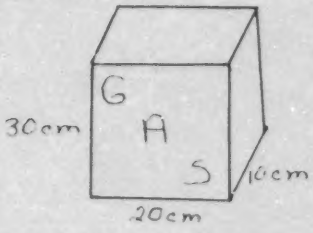


Fill your container with water. Liquid capacity is measured in liters (ℓ). The capacity of your container is approximately 1 liter. 1 liter is 1 dm^3.

Name the capacity of these containers in liters

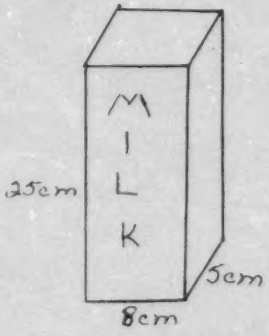
Volume	2000cm^3	500cm^3	250cm^3	80,000cm^3
Capacity	____ ℓ	____ ℓ	____ ℓ	____ ℓ

ON YOUR OWN:



Volume = ____ cm^3

Capacity = ____ ℓ



Volume = ____ cm^3

Capacity = ____ ℓ

If a car averages 5km per liter of gas, how far can it travel on 20 ℓ? ____ km.

The dimensions of the gas tank are 100 cm x 40 cm x 20 cm. How far can this car travel on a full tank? ____ km

TO BECOME FAMILIAR WITH THE DIFFERENT METRIC UNITS OF VOLUME.

Procedure: To be able to concretely visualize the units of a cm^3, liter, deka-liter, and a cubic meter the class will participate in creating these units. One cubic meter will be enough for a whole class. This could be made from pieces of dowel rods cut to a meter length. Something to fasten the rods at the corners will have to be devised. Clay would work if nothing else is available. A number of the other units could be constructed. Blocks of wood for the cm^3 would work best. After the construction of the units and the children have had ample free play with the units have them answer the following questions.

(1) Which of the units would be most efficient for measuring the volume of a swimming pool? _____

(2) Which unit would be most efficient for measuring the volume of a drinking glass? _____

(3) Which of the units would you probably use to measure the volume of your bathtub? _____

(4) Which of the units would you use to measure the volume of the sink? _____

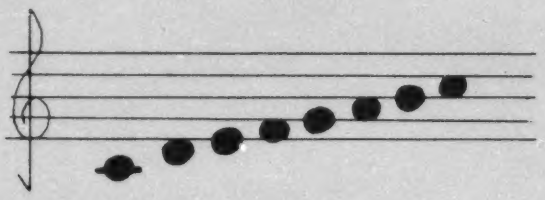
If possible, obtain graduated cylinders that are marked off in ml. On a chart such as the one below have children first estimate then accurately measure the volume of various containers. A dry measure such as sand or wheat would be most practicable.

Object	Estimated Capacity in ml.	Actual Capacity in ml.	Capacity in ℓ
1.			
2.			
3.			
4.			
5.			

MUSICAL MEASUREMENTS

Materials: 8 glasses, piano, liter beaker.

Place 8 glasses of the same height, width and volume in a row. Fill each glass with water until all of the following musical notes have been found. Use the piano to tune your glasses.



Measure each of the glasses' contents with a graduated cylinder and fill out the following chart.

C = _____ ml of water
D = _____ ml of water
E = _____ ml of water
F = _____ ml of water
G = _____ ml of water
A = _____ ml of water
B = _____ ml of water
C = _____ ml of water

Label each of the glasses of water with the note it was tuned to.

Using the end of a spoon and tapping the rim of a glass, play your favorite tune.

(Teacher's note: provide some songs with the musical letters so the child may enjoy the end product.)

CONCEPT OF VOLUME AS INSIDE SPACE, COMPARING VOLUMES

Materials: Various sized small boxes, centimeter cubes, small cans (cylinders), sand.

1. Take a few boxes and some centimeter cubes. Build a solid form with your cubes by arranging them in rows and layers.

How many cubes did you use to make your solid? _____

2. Put the cubes from your solid form into one of the small boxes. Arrange them in rows and layers. Do you think they will fill the box? Will there be too many, or too few? _____ Estimate: It will take _____ centimeter cubes to fill the box. Now fill the box. How many cubes did it take? _____

3. Use another small box. Will it hold the same number, more, or less cubes than the first box? _____ Estimate the number of cubes you think will be needed to fill the second box. _____ Fill the second box using cubes from the first. Did you use all the cubes to fill the second box? _____ Did you have too many or not enough cubes? _____ Which box is larger (which box holds more cubes?). _____ Leave the cubes in the box.

4. Take a can and fill it with cubes. Compare the can of cubes with the box of cubes. How do the cubes fit into the box? the can? Can you tell which holds more, the can or the box? _____ Dump the cubes from the can and the box back onto the table. Fill the can with sand. Will the box hold the same amount of sand, more or less? _____ Discuss how we can find out which will hold more sand. Can we count the sand like we counted the cubes? _____

5. Pour the sand from the can into the box. Does it fill the box? _____ Is there too much sand or not enough to fill the box? _____ Which holds more sand the can or the box? _____ Which is larger? _____

6. Do the same as above using different containers. First estimate then measure to find out which containers are larger.

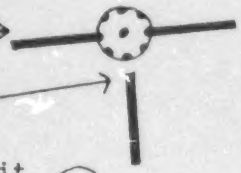
MASS AND WEIGHT

BUILDING A BALANCE

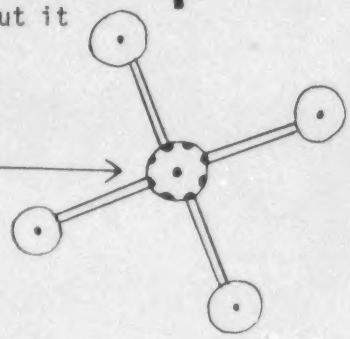
Materials: 6 tinkertoy knobs, 1 long green tinkertoy stick, 4 red tinkertoy sticks, 1 thumb tack, 2 paper clips, 1 30 cm ruler (with looseleaf binder holes). 2 small paper cups, paper clips, beans, chalk, crayons, various small articles.

Which is heavier a color crayon or a pencil? We can build a device to compare the weights of these and other small objects. This device is called a balance.

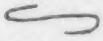
1. Get a set of materials from your teacher.
2. Take one tinkertoy knob. Put a red stick into one of the side holes. Put another red stick into the side hole opposite the first red stick.
   It should look like this



3. Now put another red stick into the middle hole between the other two red sticks. It will go here
   Take the last red stick from the set of materials and put it into the side hole opposite the third red stick.
4. Put a knob on the end of each red stick.
   So far your balance should look like this

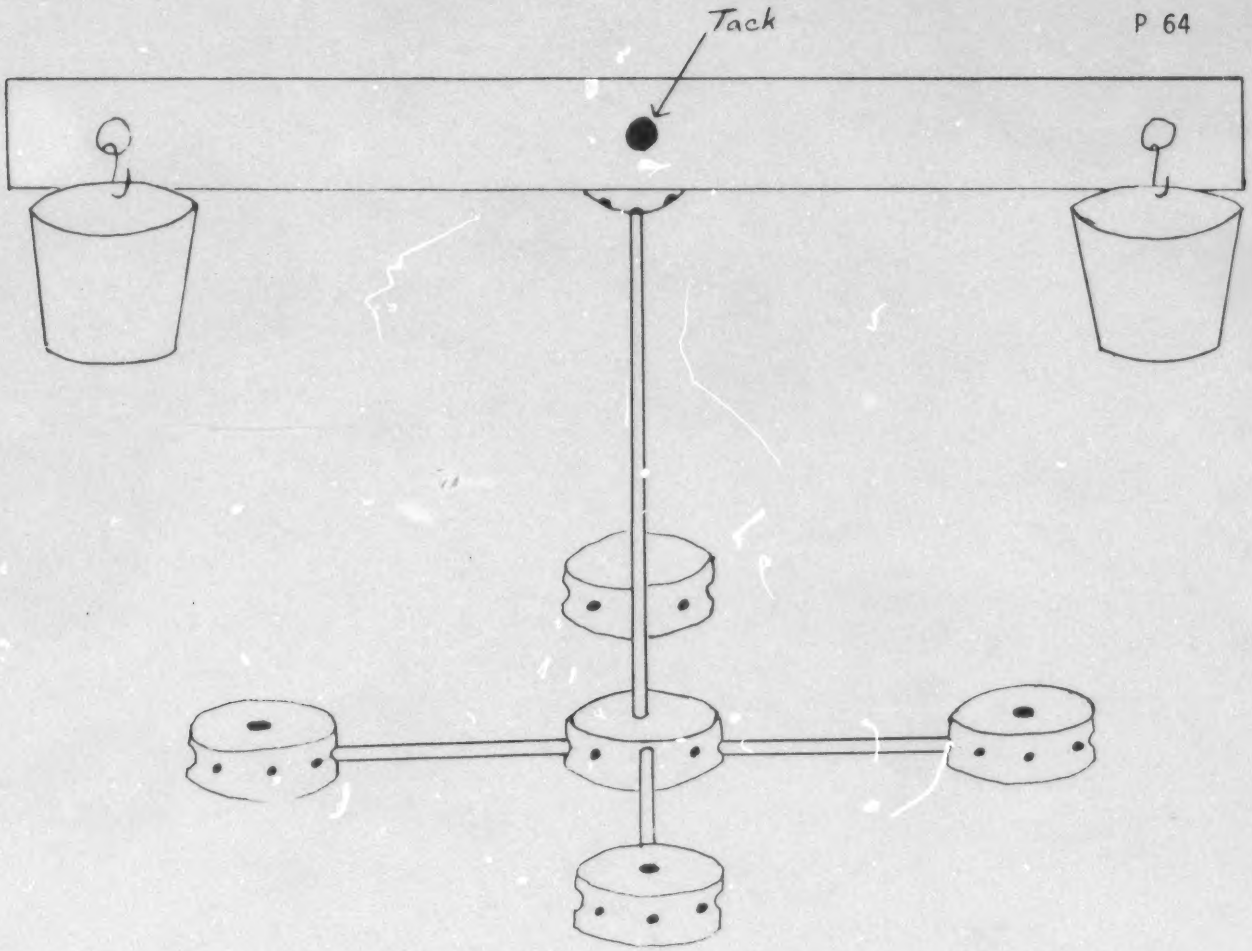


5. Stand the long green stick up in the center hole and put a knob on the top of it.
6. Put a tack through the center hole of the ruler and fasten it to the top knob. You may need help from your teacher to fasten the ruler securely.
7. Bend your paper clips out so they look like this.



8. Make a hole near the top of the paper cup and hook one end of the paper clip through the hole like this.
   Do the same with the other paper cup and clip.

9. Hook the free ends of the clips into the holes at the ends of the ruler.
   Now your balance is completed. It should look like the illustration on the following page.



10. Put your crayon in one paper cup. Put your pencil into the other.
    Which weighs more? _____

11. Put a piece of chalk in one cup. Put a crayon in the other.
    Which weighs more? _____

12. Guess which is heavier, a paper clip or a bean. _____
    Put a paper clip into one cup. Put a bean in the other.
    Which weighs more? _____

13. Compare other small objects:

14. Guess which is heavier, three beans or your pencil. _____
    Which does weigh more? _____

    How many beans does it take to equal the weight of your pencil? _____

15. How many beans does it take to equal the weight of your eraser? _____
    Which weighs more, your pencil or your eraser? _____

INTRODUCTION TO WEIGHT

Start off with a discussion concerning what pupils have observed concerning balance, e.g. a see-saw, walking on a fence, a tight-rope walker, making a mobile, etc.

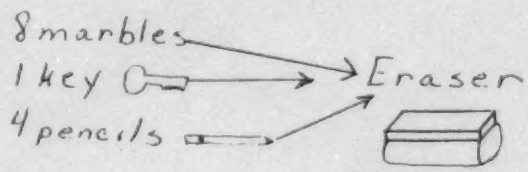
Materials: Provide a wide range of improvised balances, contrived from coat hangers, tins, plastic bowls, suspended firmly, or commercially produced balances. A wide variety of materials to weigh.

Oral directions - teacher's guide

Using any of these materials see if you can discover what items are heavier or lighter than each other.
Discover and jot down at least three different groups.
Discuss, record on board using colored chalk to help students see relationships.

Put an eraser in one dish of the balance. See what group of things together in the opposite cup can balance the scale. Record
In the same way balance and record the following:

five pieces of chalk
ten paper clips
six orange Cuisenaire rods
one level spoonful of sand



Discuss and record on board in drawing form.

Provide some assorted color-coded containers, differing size, shape and weight, with no obvious relationship between size and weight.
See if you can put these containers in order, just by looking, according to their weight from the lightest to the heaviest. Record estimations on board.
Now weigh just by handling. Record order on board.
Could you tell just by looking which was the heaviest or lightest? Which ones fooled you? Why? How many orders did you correctly guess? Is it easy or difficult to estimate weight?

Provide some seemingly identically number-coded containers, each of a different weight.
By just looking again, can you guess which order these containers would be in if we wanted to place them in order starting with the lightest and going to the heaviest? Why not? What would you have to do to find out? What do you think they might contain? Would this (content mentioned) make it heavy or light?

Let's weigh them on the scale.
Record on board or have students make a graph.

Questions

Do you know the names of some of our weight measurements?
How is pop sold at the grocery store (gram).
How much do you weigh? (kilograms) - most children should have some idea how much they weigh, if not, you could weigh a few to demonstrate.
Other items at the store: Kool-Aid, box of chips, a big bag of flour, toothpicks?
The unit of measure for the small items is called a gram.
Some items which have a lot of grams (bag of flour) are sold by kilograms or thousands of grams.
Let's try to remember the name of this unit of measure, gram.

WEIGHT USING CM^3 CUBES

Materials: Balance scale, sugar cubes, 1 gram colored cubes (yellow and blue), chalk, spoon, knife, fork, plastic cup or glass, empty pop can, pencil, bar of soap.

Lesson: Fill in the empty blanks.

1 yellow or blue cube = 1 gram
2 yellow or blue cubes = ___ grams
3 yellow or blue cubes = ___ grams
4 yellow or blue cubes = ___ grams

1 sugar cube = 2 grams
2 sugar cubes = ___ grams
3 sugar cubes = ___ grams
4 sugar cubes = ___ grams

Using sugar cubes and the little yellow and blue cubes as weights, weigh the following objects on a balance scale and record everything on the chart.

Objects	Guess - g	Number of Sugar cubes	Number of Yellow and Blue Cubes	Total in Grams
CHALK				
SPOON				
KNIFE				
FORK				
PLASTIC GLASS				
EMPTY POP CAN				
PENCIL				
BAR OF SOAP				

Which object weighed the most grams? _____

Which object weighed the fewest grams? _____

Did any objects weigh the same? _____

Which weighed more, the knife or the plastic glass? _____

How much more? _____

Find other things in the room to weigh and compare them.

WEIGHT

Material: Bathroom metric scale

WHAT DOES THE SCALE READ WHEN:

I stand on it _____ kg

I stand on it carrying 3 books _____ kg

How much do the books weigh? _____ kg

I stand on it without my shows _____ kg

How much do my shoes weigh? _____ kg

I stand on it with my friend _____ kg

How much does my friend weigh? _____ kg

Who weighs more? Me or my friend? _____ kg

I stand on it carrying a class pet _____ kg

How much does the class pet weigh? _____ kg

I squeeze the scale between my fingers _____ kg

WEIGHT

Material: A compression scale

Using the scale, weigh five or six different objects in the classroom. Record your findings on the following chart from lightest to heaviest.

Objects	Weight g Guess	Weight g Actual
1.		
2.		
3.		
4.		
5.		
6.		

With the following objects, guess between the two which one is lighter or heavier than the other. Record the findings on the following chart. (Use the scale to see if your answer is correct.)

Estimate	Objects	Weight	
		Lighter - g	Heavier - g
	book - wooden block		
	pop can - cup (with sand)		
	cup of wet sand - to dry sand		
	softball - baseball		
	eraser - box of chalk		

MASS - WEIGHT

What would you guess the weight of a nickel to be? A nickel is equal to about 5 grams. Use it as the unit of measurement when weighing five objects. First, make a guess about the weight of each object. Record it below. Next, using a simple balance scale, weigh five light objects that can be found around you. Record the weights below.

Object	Guess		Real Weight	
	(in nickels)	(in grams)	(in nickels)	(in grams)
1.				
2.				
3.				
4.				
5.				

Use this code to help you find out what this metric measurement message says.

A = 1	G = 7	M = 13	S = 19	Y = 25
B = 2	H = 8	N = 14	T = 20	Z = 26
C = 3	I = 9	O = 15	U = 21	
D = 4	J = 10	P = 16	V = 22	
E = 5	K = 11	Q = 17	W = 23	
F = 6	L = 12	R = 18	X = 24	

__ / __ __ __ __ __ __ / __ __ __ __ __ __ / __ __ __ __ __ / 5 / __ __ __ __ __ .
1 14 9 3 11 5 12 23 5 9 7 8 19 1 2 15 21 20 7 18 1 13 19

__ / __ __ __ / __ __ __ / __ / __ __ __ __ __ __ / __ __ / __ __ __ __ / __ __ /
9 3 14 21 19 5 1 14 9 3 11 5 12 20 15 8 5 12 16 13 5

__ __ __ __ __ / __ __ __ __ __ / __ __ __ __ __ __ .
23 5 9 7 8 15 20 8 5 18 20 8 9 14 7 19

Make a metric message using this code and give it to a classmate to figure out.

DETERMINING WEIGHT

Materials: Metric compression scale, 1 can tuna fish, 1 can soda pop, a flashlight battery, a nickel, a ruler and 3 - 5 objects chosen by children from the classroom.

Directions: Weigh the different objects given to you and the ones you chose. Fill in the table below and answer the questions below the table.

Object	Estimate Grams	Actual Grams
1. Tuna fish		
2. Soda pop		
3. Battery		
4. Nickel		
5. Ruler		
6.		
7.		
8.		
9.		
10.		

1. Which object weighed the most? _____
2. Which object weighed the least? _____
3. How many grams would 2 cans of tuna fish weigh? _____
4. How many grams would 6 cans of pop weigh? _____ How many kg? _____
5. How much would 5 nickels weigh? _____
6. How much would 4 batterys weigh? _____
7. Would all rulers weigh the same number of grams? _____
8. Of the objects you chose, which one weighed the least? _____
   How many milligrams would this be? _____

WATER MASSES

Materials: Weights, water, balance with cup like pans, liquid measuring utensils

1. Put one ml of water in a pan on the balance and weigh it. Record the weight on the chart below.
2. Put 10 ml of water in a pan and weigh it - record the weight.
3. Put 25 ml of water in a pan and weigh it - record the weight.
4. Put 50 ml of water in a pan and weigh it - record the weight.

	Weight in g
1 ml water	
10 ml water	
25 ml water	
50 ml water	

What kind of relationship is there between the volume and weight of water?

1. What is the weight of 9,346 ml of water?

   _____

2. How much does 90,134 ml of water weigh?

   _____

3. How much water do you have if it weighs 1 kg?

   _____

4. How much water do you have if it weighs .1g?

   _____

5. What is the volume of 612 g of water?

   _____

6. What is the weight of 934 ml of water?

   _____

7. How much does 7000 ml of water weigh in kg?

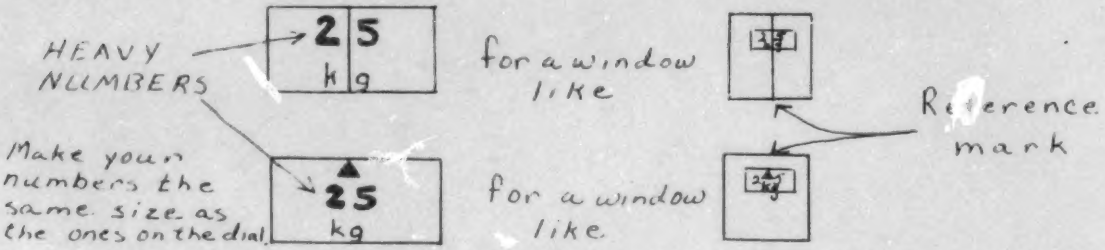
   _____

THINKING METRIC!

Materials: Sticky labels, scissors, bathroom scale

1. Take the window off the scale by peeling back the material around the window. On some scales the top cover must be unscrewed. Call a local appliance shop for advice if uncertain.

2. Make 22 labels for the numbers, starting with 5, 10, 15, 20 and so on to 110. A label might look like this:

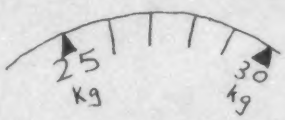


3. Using the table, stick your labels on the dial at the appropriate places. For example, the 25 would be stuck on the dial at 55 pounds, 30 at 66 pounds, 35 at 77 and so forth.

4. Use blank sticky label material to cover up all the old numbers and division marks.

5. Measure the distance between the 5 kg marks. Using that distance, go to Figure 1 and draw a line from point A to line B that is exactly as long as the distance between the 5 kg marks. Put the edge of a piece of paper on your line and mark at point A and at each place the vertical lines intersect your line. Use the paper to draw on the 1 kg subdivisions between the 5 kg marks:

6. Replace the window.



ACTIVITIES

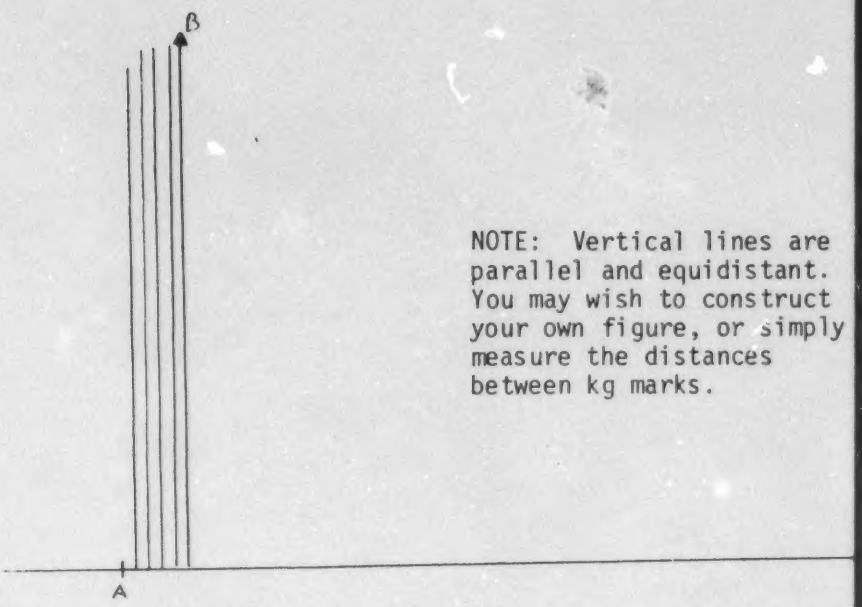
1. Have everyone weigh themselves to see how many kg they weigh. (This can lead to a number of topics, for instance a discussion of mean, average, mode, range and other statistical concepts.)

2. Can several kids add their weights to exactly equal the teacher's weight? You could prove it on a seesaw. This could lead to a discussion of levers and moments.

3. Stack up books exactly as high as the scale. Have a person stand very straight with one foot on the books and **one foot** on the scale. Record the scale reading. Then change feet and take another reading. Add the two readings. What do you get, and why? Could you use this method to weigh something like a table or the teacher's desk? Which legs of the table should you use? Why? (This could lead to a discussion of how big things like tractor-trailer trucks and airplanes are weighed.)

KILOGRAMS	POUNDS
0	0
5	11
10	22
15	33
20	45
25	55
30	66
35	77
40	88
45	99
50	110
55	121
60	132
65	143
70	154
75	165
80	176
85	187
90	198
95	209
100	220
105	231
110	243

Figure 1

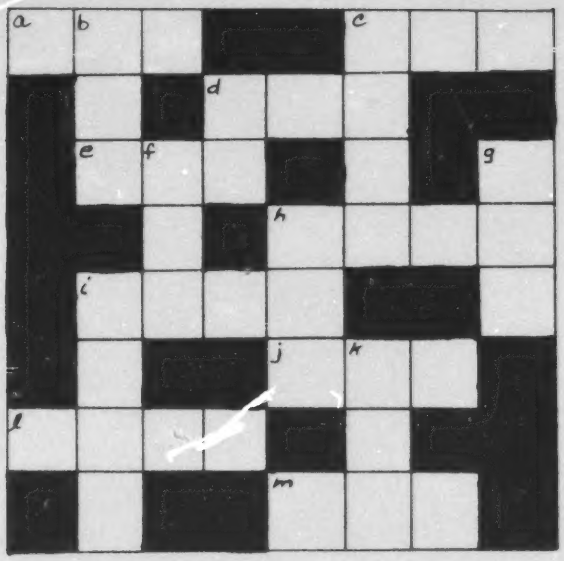


NOTE: Vertical lines are parallel and equidistant. You may wish to construct your own figure, or simply measure the distances between kg marks.

CROSS-NUMBER PUZZLE

A puzzle converting from one metric unit of weight to another.

Complete the cross-number puzzle using the clues below.



b. 600 dg + 5400 cg = ____ g
c. 3 g + 10 cg = ____ mg
d. 400 dg + 1200 cg = ____ g
f. 2 g + 12.5 dg = ____ cg
g. 21 g + 1.5 cg = ____ mg
h. 1.5 dg + 0.225 g = ____ mg
i. 40 g + 1560 mg = ____ cg
k. 3000 dg + 2800cg = ____ g

a. 3 dg + 31.6 cg = ____ mg
c. 3 g + 40 mg = ____ cg
d. 500 g + 51,000 mg = ____ g
h. 3 g + 6.2 cg = ____ mg
i. 45 g + 370 mg = ____ cg
j. 5,000,000 mg + 3800 cg = ____ g
k. 6 g + 25.61 dg = ____ mg
l. .25 g + 33.6 cg = ____ mg

EQUIVALENT WEIGHTS

Find the equivalent weights that name a tic-tac-toe.

1 kg	10 g	1 hg
2 hg	1000 g	1 kg
10 dag	1000 mg	10,000 dg

1 cg	1 dg	1 g
1 mg	10 dg	100 cg
1000 mg	100 cg	100 dg

20 dag	2000 g	200,000 mg
200 hg	2 kg	20 g
200 g	2,000,000 mg	.2 kg

10 dag	100 g	100 cg
100 cg	1 dag	10 dg
1 dag	10 g	1000 mg

1 kg	.1 hg	10 g
10 hg	.01 kg	100 dg
100 dag	10 kg	1 dag

1000 mg	1 dag	1 dag
10 dg	10 g	.01 cg
100 g	100 dg	.001 kg

DETERMINING WEIGHT

Unit of weight: gram
1000 grams (g) = 1 kilogram (kg)
1000 kilograms = 1 metric ton

Objects:

a 1 gram jelly bean

a 2 1/2 gram hummingbird

a 340 gram package of cereal

a 1 metric ton pair of bears

a 1 kilogram sack of apples

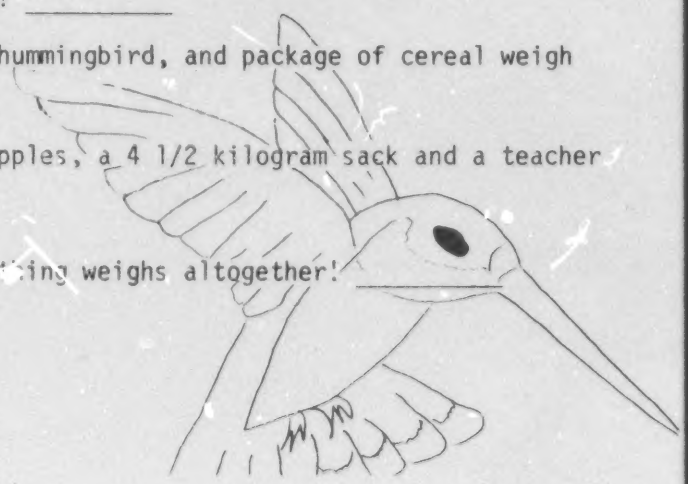
a 4 1/2 kilogram sack

a 56 kilogram teacher

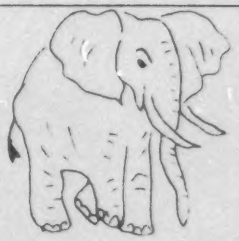
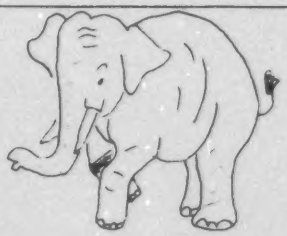
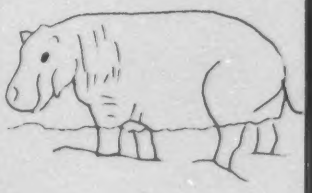
a 115 metric ton blue whale (same as 115,000 kilograms or 115,000,000 grams)

1. What things could you carry? _____
2. What things are too heavy to carry? _____
3. How much would one sack of apples weigh? _____
   four sacks of apples? _____
4. How many grams would a sack of 500 jelly beans weigh? _____
5. What would three pairs of bears weigh? _____
6. How many pairs of bears is equal to the weight of one blue whale? _____
7. How many jelly beans would you need to equal the weight of one blue whale? _____
8. How many jelly beans would you need to equal two boxes of cereal? _____
9. How many kilograms does one bear weigh? _____
10. How many tons would ten bears weigh? _____
11. How many grams would a jelly bean, hummingbird, and package of cereal weigh altogether? _____
12. How many kilograms would a bag of apples, a 4 1/2 kilogram sack and a teacher weigh altogether? _____

*13. If you can, find out how much everything weighs altogether! _____



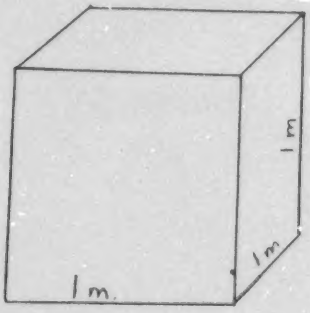
ZOO PARADE

			
Tiger 180 kg	African Elephant 5,400 kg	Asian Elephant 3,150 kg	Hippopotamus 3,600 kg
Camel 450 kg	Gorilla 200 kg	Zebra 410 kg	Lion 225 kg

1. How many grams does each of these animals weigh?
   tiger _____ gorilla _____ hippopotamus _____
   camel _____ lion _____ zebra _____
2. Find the total weight of the two lightest animals. _____
3. Find the total weight of the three heaviest animals. _____
4. What is the total weight of the Asian elephant and the lion? _____
5. What is the total weight of the zebra and the camel? _____
6. How much more does the African elephant weigh than the Asian elephant? _____
7. A metric ton (t) is 1,000 kilograms. Which animals weigh more than a metric ton? _____
   What is their total weight in metric tons? _____
8. How many metric tons do the tiger, gorilla, zebra, lion, and camel weigh? _____
9. How many camels would equal the weight of the hippopotamus? _____

METRIC TON

Think of building this tank shown below.



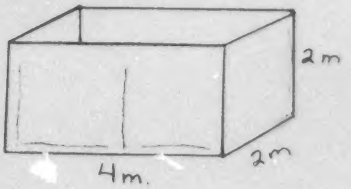
1. The volume of the tank is _____ m^3.
2. The volume is also _____ dm^3.

Suppose you filled the tank with water.

3. Since $1dm^3$ = 1 liter, it can hold _____ ℓ.
4. 1000 liters = _____ kg.
5. Since 1 liter of water weighs 1 kg, the water in the tank would weigh _____ kg.

Another name for 1000kg is 1 metric ton (t)

1 t = 1000 kg



6. A storage tank has the dimensions shown. It is completely filled with water. What is the weight of the water? _____ t
7. The weight of each player on a football team is given:

Max - 72 kg	Bill - 93 kg	Jose' - 84 kg
Don - 78 kg	Rex - 70 kg	John - 82 kg
Jeff - 87 kg	Gene - 75 kg	Ken - 80 kg
Tony - 87 kg	Randy - 96 kg	

Is their combined weight more or less than 1 metric ton? _____ By how many grams? _____

8. Complete the following:

1000 mg = _____ g	1000 kg = _____ t	2000 g = _____ kg
1000 g = _____ kg	3 g = _____ mg	5 t = _____ kg

ESTIMATE THE WEIGHT OF OBJECTS COMMONLY SEEN

Materials: Counterbalance scale, metric weights, collection of items with a wide range in mass. Some examples: paperclips, pennies, arithmetic book, empty liter flask, liter flask filled with water, 300 kernels of unpopped corn, 300 kernels of popped corn, bottle of ink, bottle of glue, chunk of lead, bag of feathers, an apple and an orange, baseball and football, etc.

Activity:

1. Divide the class into three teams.
2. Select ten or twelve items from your collection of objects. Ask each team to prepare a list of the items, agree upon an estimate of the weight of each item before weighing it, then record their estimate and not change it.
3. Ask each team to weigh each item on the list, record the weights and find the difference between its estimate and the actual weight of each item.
4. When the weighing is finished, compare the lists of objects, estimates and weights. The team whose estimate of an object comes closest to its actual weight wins three points, the second ranking team wins two points, and the third ranking team wins one point. After all objects on the list have been considered, the team with the most points is declared the winner.

MASS MINDED

Materials: One-piece balance, liter pitcher graduated in milliliters, sand, peas, pinto beans, wheat, popcorn, water, any comparable substance.

We know that one liter of water has a mass of kilogram. Do different substances of like volume have the same mass? In order to find out, gather together a group of different substances. One by one measure 100 ml of each substance and weigh it.

Substance	Volume	Mass
	100 ml	
	100 ml	
	100 ml	
	100 ml	
	100 ml	
	100 ml	
	100 ml	

Which substance has the greatest mass per 100 ml? _____

Which substance has the least mass per 100 ml? _____

TO DISCOVER THE APPROXIMATE WEIGHT OF FAMILIAR OBJECTS IN GRAMS

Materials: Large number of nickels (approximately 5 grams each), a number of size "D" flashlight batteries (approximately 100 grams each), straight pins (approximately .5 grams each), balances or scales.

Procedure:

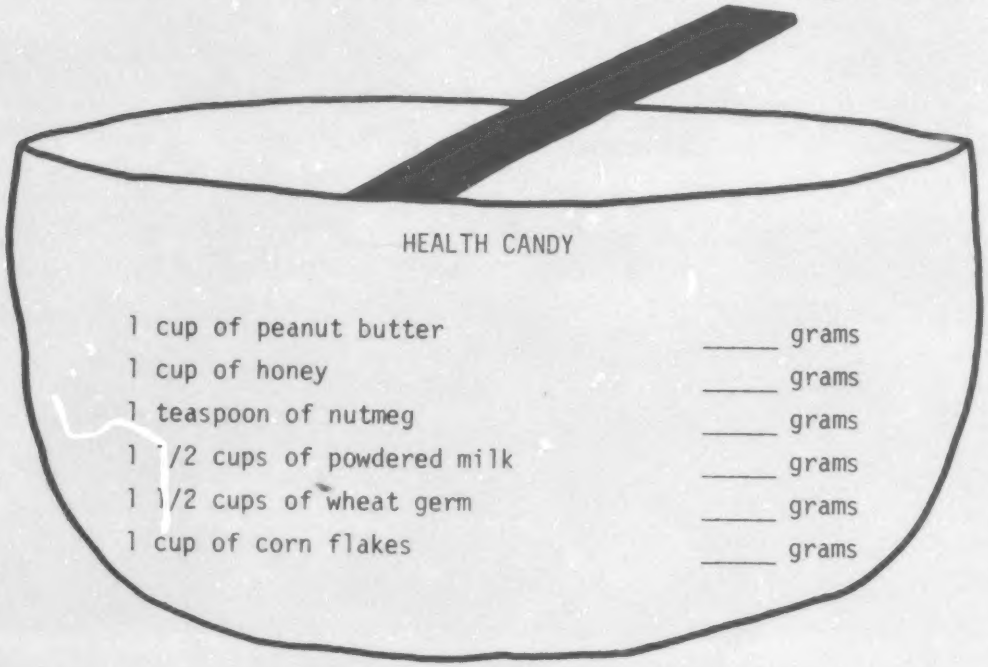
To begin to get a feel for measuring weight in the metric system the children should create a chart as the one below. Children should at first be encouraged to measure or weigh things that are common or familiar to them. They can then use these objects as easy references. After their experiences using metric units of mass (weight) they should be confronted with guestions like the following:

1. Would grams or kilograms be more practical to measure the weight of a man or woman? _____
2. Would the weight of an automobile best be stated in grams, kilograms, or metric tons? _____
3. Would you be more accurate measuring the mass of a can of pop in grams or kilograms? _____
4. How much do you think you weigh in kilograms? _____ How can you find out? _____

Object	Weight in Grams	Weight in Kilograms	Weight in Milligrams
1.			
2.			
3.			
4.			
5.			
6.			
7.			

METRIC RECIPE

Before making the candy weigh out your ingredients on the gram scale.



HEALTH CANDY

1 cup of peanut butter	_____ grams
1 cup of honey	_____ grams
1 teaspoon of nutmeg	_____ grams
1 1/2 cups of powdered milk	_____ grams
1 1/2 cups of wheat germ	_____ grams
1 cup of corn flakes	_____ grams

1. Put the peanut butter, honey, nutmeg, powdered milk, and wheat germ into a bowl.
2. Mix well.
3. Shape mixture into little balls.
4. Put the corn flakes into a plastic bag. Crush the corn flakes in the bag with a rolling pin.
5. Roll the balls in the corn flakes. Now they're ready to eat.

TEMPERATURE

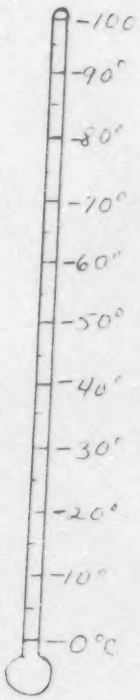
CELSIUS

Materials: 1 kettle (about 1 liter), water, hot plate, Celsius thermometer, Bowl of ice cubes.

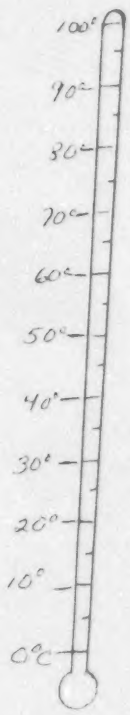
Activity:

Place the thermometer in the bowl of ice cubes. When the mercury stops receding, record the temperature on the chart provided.

Fill the kettle about half full of water. Place it on the burner and turn the burner on. Record the temperatures on the thermometers below at the times given and record them on the chart.



Right away



After 5 minutes

Mark the rest on your own.

After another 5 minutes (10 minutes)

After 11 minutes

After 12 minutes

After 13 minutes

After 14 minutes

After it is boiling

ice freezing	°C
right away	°C
5 minutes	°C
10 minutes	°C
11 minutes	°C
12 minutes	°C
13 minutes	°C
14 minutes	°C
boiling	°C

TEMPERATURES

Materials: Celsius ribbon thermometer, Celsius thermometers (indoors, outdoor, body), calendar.

Temperature is the degree of hotness or coldness of anything. Everything has a temperature. We can measure temperature with a device called a thermometer. Your teacher will show you how to use and read a thermometer.

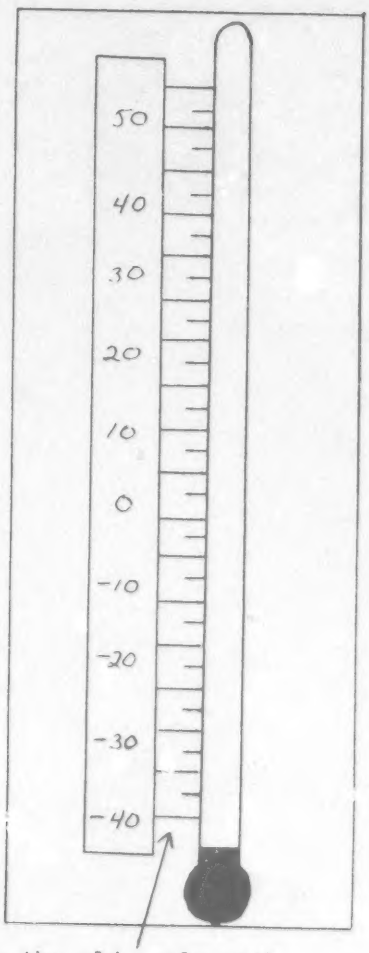
1. Measure and record the following temperatures:
   A. What is the temperature inside our classroom today? _____
   B. What is the temperature outside today? _____
   C. Is the outside temperature the same in the winter as in the summer? _____
   D. Which temperatures do you like best, winter or summer? _____
      Why? _____
2. Estimate, measure and record:
   A. What do you think the temperature of the water is when you wash your hands? _____ Check with thermometer and record. _____
   B. What do you think the temperature of the water is when you take a drink? _____ Check with thermometer and record. _____
   c. What is the temperature of the water when it is too hot to wash your hands? _____
3. What do you think the temperature of your body is? _____
   Normal body temperature is 37°C. Take your temperature and record it here _____.
4. Keep a record of the daily outside temperature.
   A. Check the outside temperature.
   B. Duplicate the reading of the outdoor thermometer on the ribbon thermometer.
   C. Record the temperature on the calendar daily.

LIVE METRIC - MAKE A CELSIUS THERMOMETER

Materials: Fahrenheit thermometer, sticky labels.

Cover the degrees of your Fahrenheit thermometer with the sticky labels. Using the chart below write in the Celsius degrees. For example, where 32°F was put 0°C; where 50°F was put 10°C, and so on.

Celsius	Fahrenheit
-40	-40
-30	-22
-20	- 4
-10	14
0	32
10	50
20	68
30	86
40	104
50	122



Now cover up the subdivision marks on the old scale with sticky labels. You can estimate the subdivisions on your new Celsius thermometer.

CELSIUS TEMPERATURE

When we compare the Celsius scale with the Fahrenheit scale of temperature, we see that the Celsius scale goes from freezing to boiling with a change of only 100°, whereas the Fahrenheit scale goes from freezing to boiling in 180°. The mercury does cover the same distance on the scale. This means that the Fahrenheit scale would be the smaller unit, since it needs more marks than the Celsius scale to cover an equal distance.

For the next week, listen to a radio station or on the television to get the temperature for the day in Celsius degrees.

Monday _____°C
Tuesday _____°C
Wednesday _____°C
Thrusday _____°C
Friday _____°C
Saturday _____°C
Sunday _____°C

Read the classroom's thermometer and record the answer in Celsius degrees.

Today's temperature in the room is _____°C

Take a glass and fill it with ice cubes and use the Celsius scale to get the temperature of the ice. Then place the ice cubes in water and record that answer. Place the water and ice cubes in a pan and place them on the burner until the water begins to boil. Remove the pan from the burner, and take the temperature.

ice cubes _____°C
water and ice cubes _____°C
boiling water _____°C

TEMPERATURE

It's the year 1980. You are living in the United States, now a completely metricated country. For the past week you have been visiting Terry and Kristi. Although you have done your homework and know the metric system, Terry and Kristi are not as well prepared, especially about weather reports. Fill in the blanks for the answers Terry and Kristi need help with.

Early Spring Morning

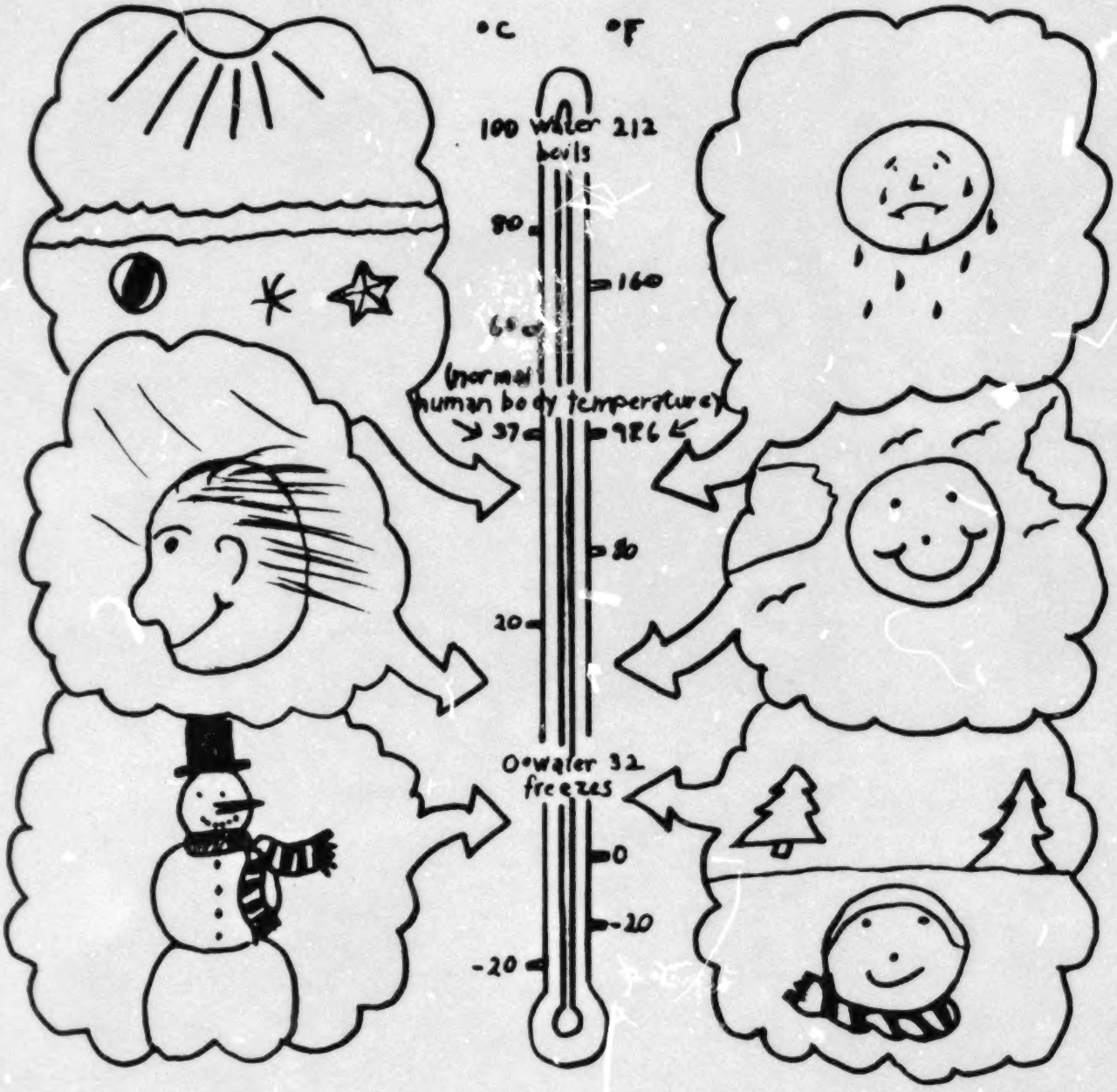
Arghhh. Terry sounds tired. His sister Kristi flips on the radio. "Good morning all you happy listeners in KFJM land! It's a lovely day. The wind is 15 kilometers an hour with gusts up to 40 kilometers. The temperature is now 15°."
"Hmm, 15°. That sounds pretty cold," said Terry.
You say, "_____."
"The weatherman said it's a lovely day," said Kristi. She puts on a light jacket. You put on _____.
Terry zips up his parka. You all go outside. Kristi shivers, Terry sweats, and you _____.

Dreary Fall Day

"It's raining," said Terry. "I feel lazy today."
"Don't be glum," said Kristi. "I made up a quiz to get you awake."
"O.K., what's the first question?" Terry asked.
"Would I feel great in a 98° bath?"
"Well, ah," Terry dawdled.
You say, "_____."
"Second question - is 37° a fever?"
"Why! That's way below normal," yelled Terry.
You say,"_____."
"Third question. Is 18° a good temperature for football?"
You say,"_____."

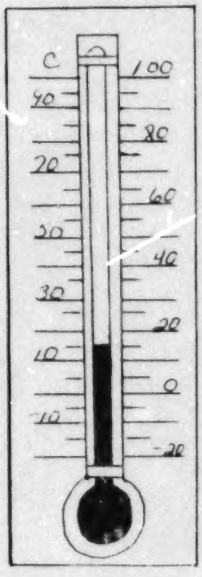
Fourth of July

"I'm so hot," complained Terry. "The thermometer says it's 35°."
Kristi brings in a liter of lemonade. She gives you each a glass and says, "I'll put the rest in the freezer to keep it cold." An hour later she takes it out and you hear her saying, "Oh no! It's frozen stiff as a brick! The temperature must have gone below...below...
You say,"_____."
The pitcher is left on the table until hours later you pour some out for yourself. "Yich. It's warm! It must be as hot as the air around us so that makes it about _____ degrees."

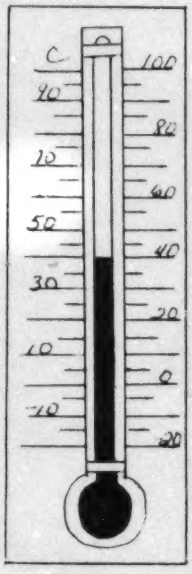

°C
°F
100 water boils 212
80
160
(normal human body temperature)
37
98.6
80
20
0° water 32 freezes
0
-20
-20

WORKING WITH THE THERMOMETER

Write the temperatures.

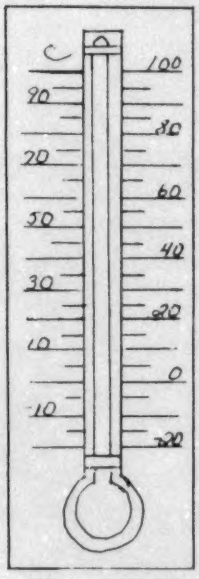


_____

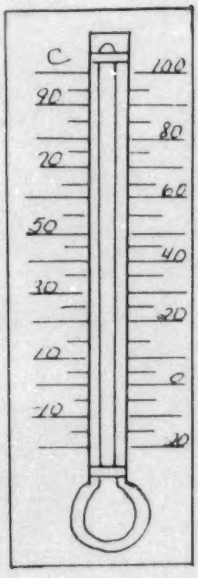


_____

Show the temperatures.



-15°



55°

Circle the correct temperature.

1. A hot summer day

   35°C 100°C 85°C

2. John is sick:

   102°C 98°C 38°C

3. Ice skating weather:

   -10°C 10°C 5°C

4. Baking a cake:

   190°C 350°C 100°C

5. The water is boiling:

   212°C 100°C 50°C

6. The room is too warm:

   20°C 78°C 25°C

A. The temperature was 25°C. It dropped 30°. What is the temperature?

_____

B. The temperature was -12°. It rose 27°. What is the temperature?

_____

C. The temperature was -15°. It rose 15°. What is the temperature?

_____

D. The temperature was -5°. It rose 10°. Then it rose 25°. What is the temperature? _____

THINGS TO DO WITH YOUR CELSIUS THERMOMETER

Materials: Homemade Celsius thermometer, extended-scale commercial instrument (optional), wet-bulb thermometer/sling psychrometer (optional), books on weather instruments (optional), ice/hot plate (optional).

1. Record the temperature at different times during the day. What temperature seems 'just right' to you? At what temperature do you start to feel hot? cold?
2. Mount thermometers on one wall, one near the floor, one at eye level, and one near the ceiling. Compare the readings. Are there differences? Why?
3. Mount one thermometer on the outside of a window, and another thermometer inside the window. Do they always read the same? Why?
4. Hang one thermometer in the sun and another in the shade. Do they read the same? Why? Which method (sun or shade) does the weatherman use?
5. In winter (or in air conditioned buildings, also in summer) mount one thermometer on an outside wall (one whose other side is the outside of the building) and mount another thermometer on an inside wall at least a meter from an outside wall or a window. Do they read the same? Why? (can lead to a discussion of insulation.)
6. If you have a fan, compare the reading of a thermometer being blown on with a thermometer that is in calm air. Do you think there will be a difference in readings? Why? Prove it. Was your guess correct? Why? Is <u>your</u> temperature different if you are standing in front of the fan or not? Why? (could lead to a discussion of the function of perspiration, or wet-bulb thermometers used by weathermen.)
7. Have everyone hold his thermometer inside his hand. Do all the thermometers read the same? Why? Do you think the teacher's thermometer will read higher or lower than yours? Why? Prove it.
8. Some people can change the temperature of their body by thinking very hard about hot things or cold things. Can you change your body temperature? How many degrees?
9. Get two identical pans of water at the same temperature. Feel each pan to be sure they are the same. Add enough hot water to one pan to raise the temperature 1°C. Have someone else switch the pans around so you don't know which one is hotter. Can you feel the difference between pans? If not, add more hot water to

the warmer pan to make the temperature 2°C higher, and so on until you can definitely tell one is hotter than the other. How much difference in temperature was needed before you could tell the difference? Do the same thing, only adding cold water. Compare results.

10. Measure and record the temperature of: water from the cold water fountain, cold tap water, hot tap water, aquarium water, boiling water, ice water, your lunch milk, and other things you can think of. Some thermometers can't measure very hot things, so use caution. (Mercury, which is always silver, is highly poisonous. If a mercury thermometer gets broken, don't mess around with the mercury.)